# WATER WORKS & SEWERAGE

A GILLETTE ABP ABC PUBLICATION

ol. 86, No. 4 APRIL, 1939 L. H. Enslow Editor

## AMERICA'S LARGEST MUNICIPAL ZEOLITE SOFTENING PLANT

An Addition to the Filter Plant of Clarksburg, West Virginia, Described in Article by Scotland G. Highland Beginning on Page 123 of this Issue

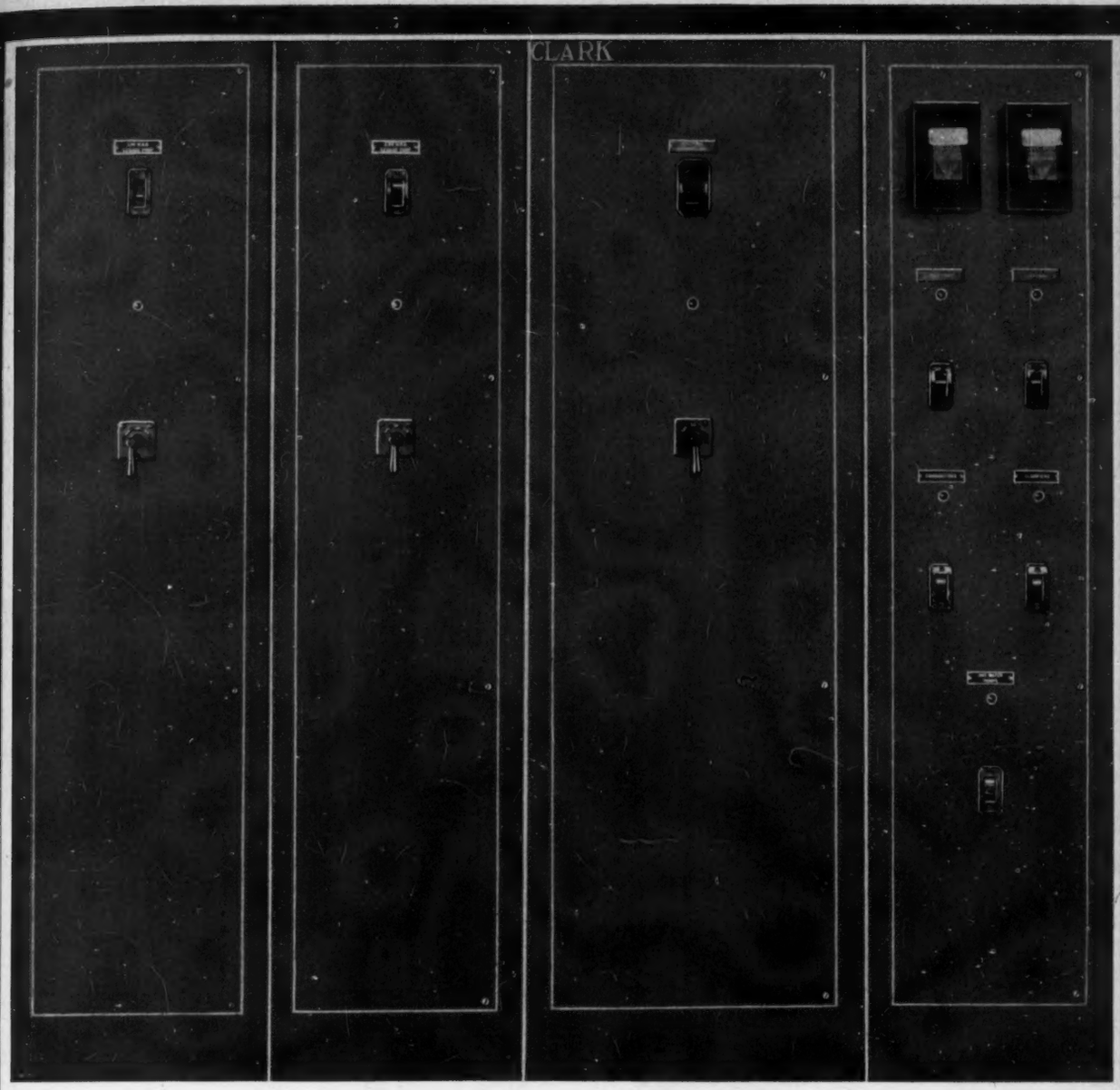
Lithographed on stone by James E. Allen for U. S. Pipe & Foundry Co. Copyright 1939, U. S. Pipe & Foundry Co.

A Spring reminder that you can buy *chill-free* centrifugally cast Super-de Lavaud Pipe for practically any kind of construction. It is available in 12 or 18-foot lengths, 3 to 24-inch diameters, lined or unlined, bell-and-spigot or with mechanical joints, plain or threaded ends, and in culvert types and sizes.

**U.S.**
cast iron
**PIPE**

*United States Pipe & Foundry Co., Burlington, N.J.*

*Plants and Sales Offices throughout the United States.*




¶ This "3C" Dead Front Steel Panel Switch Board is typical of the neatness necessary for the trim and tidy appearance of control rooms in Sewage Disposal Plants.

¶ In addition to operator safety of the Dead Front construction, there's protection for the motors in the "3C" apparatus mounted on an Ebony Asbestos Panel back of it. Steel grill work completely encloses the top, sides and back of this installation, but all apparatus is completely accessible through the hinged doors on each front section.

¶ Controlled by a Multi-Stage Float operated device, are 20—30—60 H. P., 3 phase, 60 cycle, 440 volt, Wound Rotor Motors driving 1.44, 2.88, and 5.76 MGD, Sewage Pumps. Relay control is also supplied for operation of cone valves associated with Sewage Pump Lines.

¶ Also controlled by Circuit Breakers, Transfer Switch, Contactors, Motor Starters, etc., are 1 —1 H. P. Sump Pump Motor, 2—3 H. P. Sludge Pump Motors, 2—1½ H. P. Comminutor Motors, 2—½ H. P. Clarifier Motors, and 2—¼ H. P. Hot Water Circulating Pump Motors.

¶ *Your inquiries regarding Sewage Disposal and Pumping Plant electrical controls will receive prompt and experienced engineering attention.*

OFFICES IN PRINCIPAL CITIES

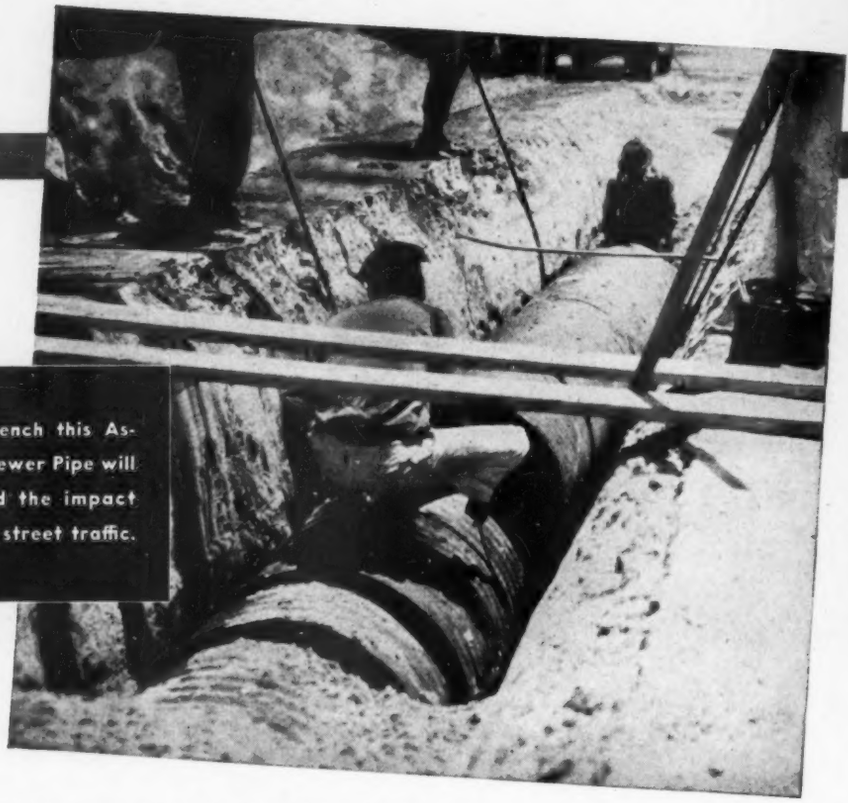
THE CLARK CONTROLLER CO.

1146 EAST 152ND ST. CLEVELAND, OHIO


WATER WORKS AND SEWERAGE, April, 1939. Volume 86. Number 4. Published monthly at 330 South Wells Street, Chicago, Ill., by the Gillette Publishing Company. Per copy, 25c. Subscription rate, United States and Canada, $2.00 per year; Foreign, $3.00 per year. Copyright, 1939. Entered as Second Class Matter, June 2, 1931, at the Post Office at Chicago, Ill., under Act of March 3, 1879. Additional Second Class Entry at Pontiac, Illinois.

# You Dig Only Once

## FOR ARMCO SEWER PIPE



Placed in a shallow trench this Asbestos-Bonded Armco Sewer Pipe will successfully withstand the impact and vibration of heavy street traffic.

**No need to replace broken sections; repair leaky inefficient joints; or remove troublesome tree roots, not when you use Armco Sewer Pipe.**

• Years ago when things went "wrong" with sewers, they were taken for granted. But today many engineers feel different; because they realize that the cost of maintenance and sewage treatment can be greatly reduced by using Armco Sewer Pipe.

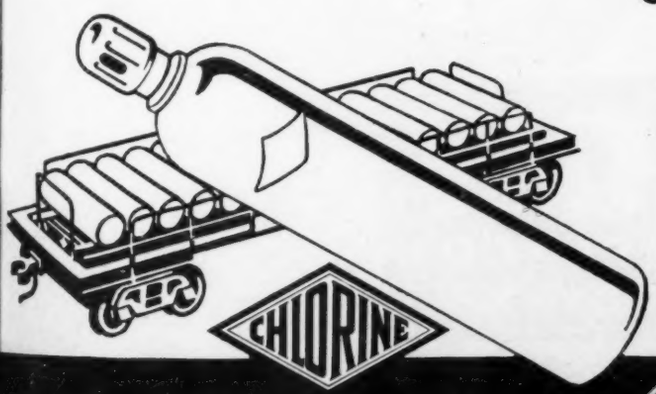
Here, truly, is one sewer pipe you can install and forget. Neither heavy loads, traffic impact nor splitting frost action will harm it. Then too, thanks to its flexible corrugated iron design and tightly coupled joints, Armco Sewer Pipe holds its grade and alignment in the most unstable soil without admitting tree roots or ground water.

It will serve a long, long time, too, because Armco Sewer Pipe is made of galvanized ARMCO Ingot Iron—proved by 33 years of service. Besides, it's paved in the bottom and fully coated with a special bituminous material securely bonded to the pipe. Write for the 48-page Armco Sewer Book. Armco Culvert Mfrs. Assn., Middletown, Ohio.

**ASBESTOS-BONDED ARMCO SEWER PIPE**

A PRODUCT ORIGINATED AND DEVELOPED BY ARMCO ENGINEERS

*Make sure they always have Pure water*




—With the sure and dependable aid of Diamond Liquid Chlorine—used and preferred the nation over for its absolute uniformity the year around. Quick deliveries in 100 and 150 pound cylinders are always assured through your local Diamond distributor. Larger quantities are shipped direct from the Diamond plants at Painesville, Ohio.

**DIAMOND ALKALI COMPANY, Pittsburgh and Everywhere**

**DIAMOND *Liquid* CHLORINE**

# WHAT TO DEMAND OF A *Hydrant . . . and a Valve*

- *Quick Water* with least possible shock. Proper shut-off without water hammer.
- *Proper Drainage*. Hydrant automatically drained at *lowest* point when closed.
- *No Flooding*. Accidental breaking of the hydrant, such as might result by collision from a heavy truck, will not cause flood since the gate when closed is wedge-locked.
- *Easy Inspection and Servicing* without unscrewing anything below the ground level. All working parts removed as one unit by lifting stem through top of hydrant.

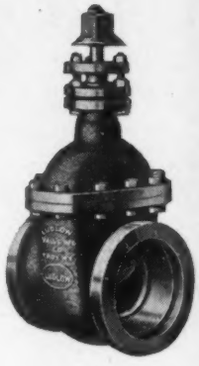
Only the slide gate principle provides *all* these advantages. This principle, developed and perfected by Ludlow, has been the universally accepted construction in all *water works valves* for nearly three-quarters of a century. It likewise insures *complete security* in fire hydrants.

Full information free on request.

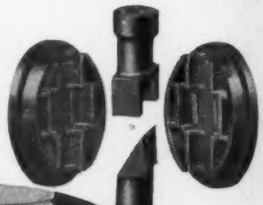
- *Smooth, Positive Operation*. Gates positioned *directly* opposite ports before wedging, and entirely unwedged *before* being raised.
- *Positive Closure* — even after years of service in the open position; flexible-action gates *self-adjusting* to seats.
- *Self-Cleaning*. Rings cleaned *throughout entire stroke*. No *internal guides* to cause foul-up.
- *Ready Replacement of Parts*. Simple construction with ample tolerances, permitting ready replacement of parts.

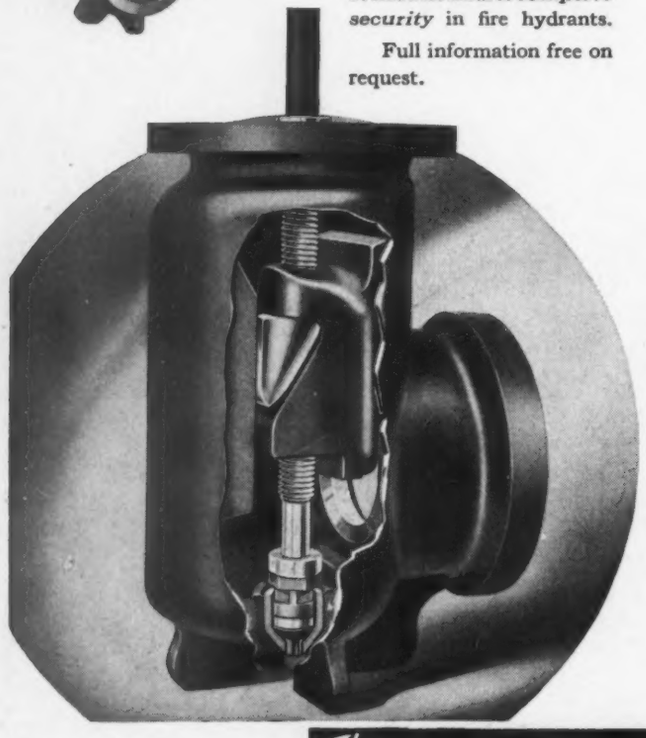
Only the parallel seat, double wedge type slide gate valve provides *all* these essential benefits. This principle, developed and perfected by Ludlow, has been the universally accepted construction in all water works valves for nearly three-quarters of a century.

Full information free on request.

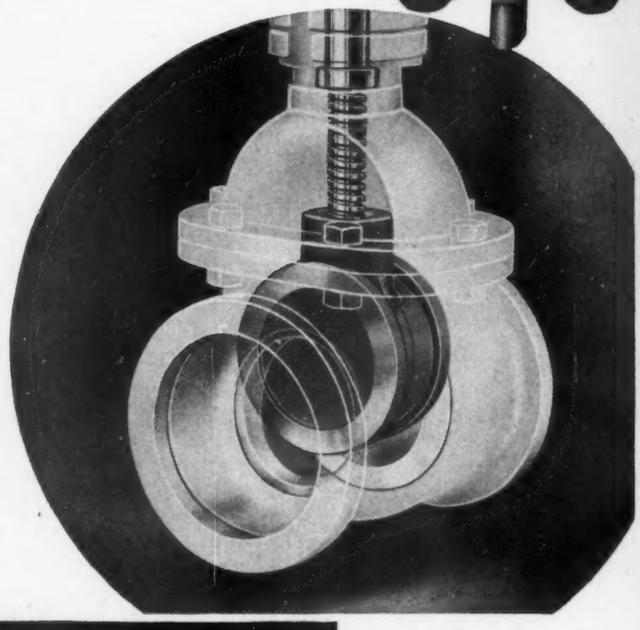


**LUDLOW PRINCIPLE**
Self-releasing 30° angle wedges and flexible action gates self-adjusting to seats for improved performance, longer life.





Notice the sound engineering of the wedge-lock principle, and its simple, sturdy construction.



Experienced water works men call this the "most flexible" valve. Many years of trouble-free service have proved unmatchable superiority.

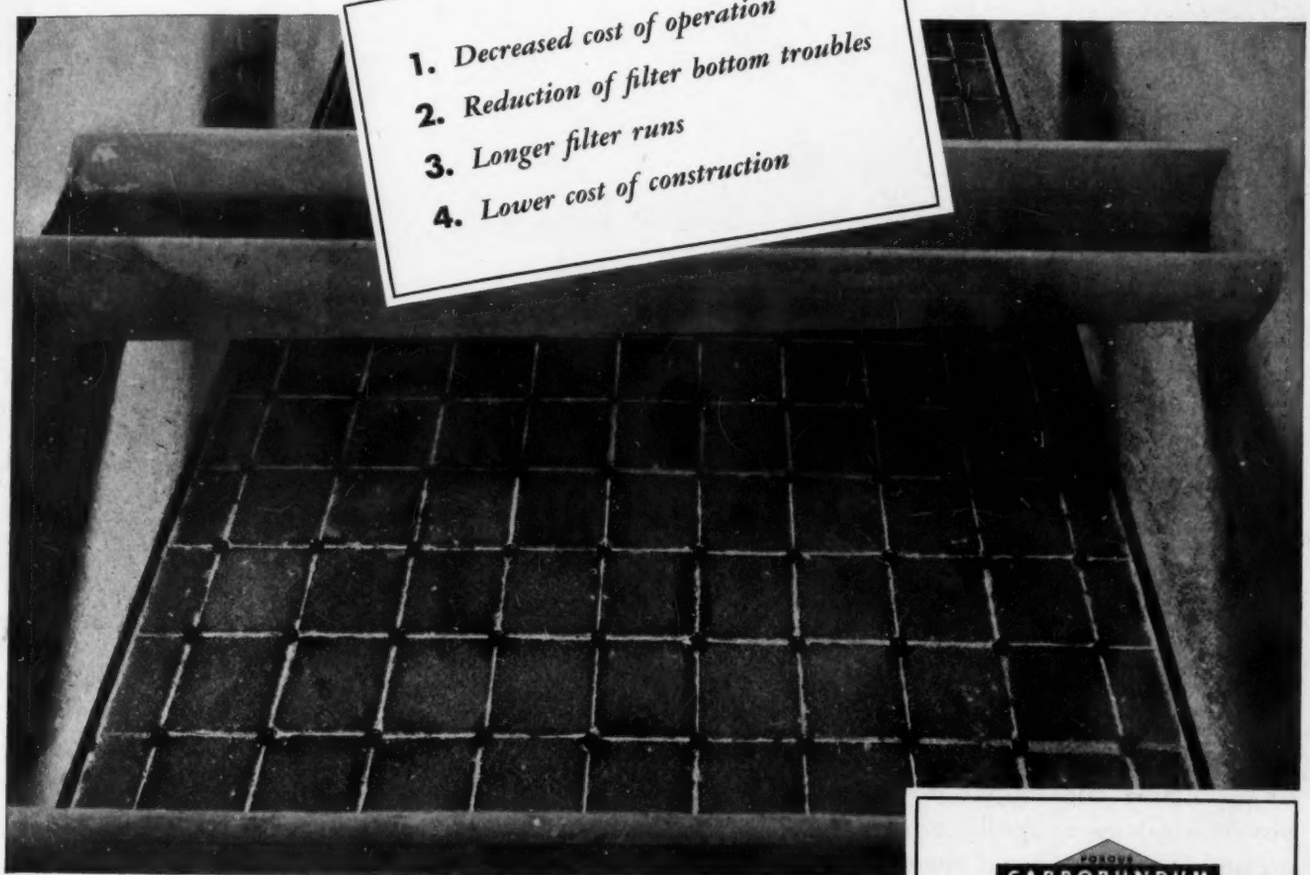
The LUDLOW VALVE MFG·CO· TROY·N·Y· SINCE 1866

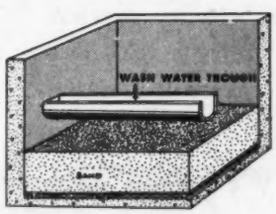
# 29 INSTALLATIONS

## *are now proving the benefits of the Aloxite Brand Porous Underdrain System for rapid filters*

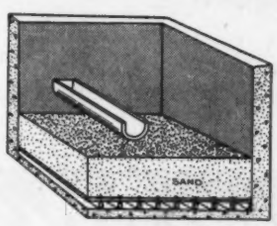
These benefits are realized through the inherent simplicity of design. Graded gravel is eliminated entirely. All vertical dimensions may be reduced accordingly. Write for further details. Our sanitary engineers are anxious to cooperate with consulting engineers and plant superintendents who are considering the design of new filters or the rehabilitation of old filters.

1. *Decreased cost of operation*
2. *Reduction of filter bottom troubles*
3. *Longer filter runs*
4. *Lower cost of construction*






*Filter with channeled plates*




*Filter with plain plates supported on concrete piers*

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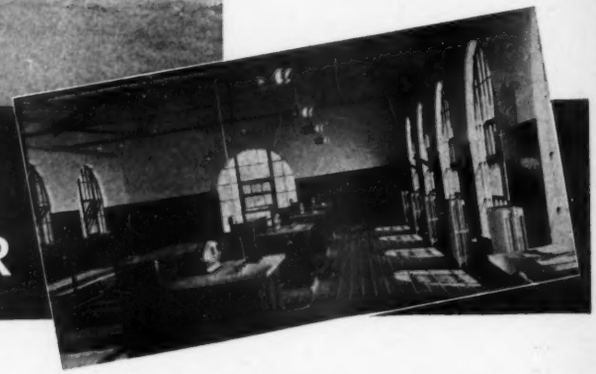
# MATHIESON *HTH* FOR SAFE BEACHES

**Says George R. Young, Village Manager, Village of Glencoe, Illinois: March 7, 1939**

"You will be interested in our successful use of HTH on our Lake Michigan Beach . . . Two problems were involved: foot infections from the bacteria in the sand, and insects . . . HTH was tried, using a 2% solution. We were able with this solution sprayed on the sand to reduce the fly egg count from 800 per square inch to almost none. We eliminated bacteria and foot infection completely, so far as we were able to determine. We feel that the added satisfaction and confidence inspired in our Glencoe residents who use the beach was well worth while . . . In the past ten years we have enjoyed excellent service from your company."

• *Municipal Bathing Beach Glencoe, Illinois*



• *Filtration Plant Glencoe, Illinois Waterworks*

## MATHIESON CHLORINE FOR SAFE DRINKING WATER

HTH is a dry, free-flowing chlorine carrier. 70% of its weight is chlorine available for killing bacteria and destroying odors and other objectionable contamination. Its germ-killing power is released rapidly, uniformly — requires no bulky equipment, no specially expert or experienced operator. Best of all HTH really does the job.

Glencoe is only one of the many villages, towns and great cities throughout the country that have found in HTH and Mathieson Chlorine the ideal solution of the problem of water purification, sewage treatment, beach and pool sanitation.

Mathieson Chlorine means a pure, dependable product — safe, trouble-free containers and valves — prompt delivery service. In addition you have available the full cooperation of Mathieson's expert technical staff.

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# HOW TO PICK THE RIGHT GATE OR GLOBE VALVE FOR A SPECIFIC SERVICE

THERE is no such thing as any one valve to meet *every* service. The very feature, for instance, that makes a ball type disc valve ideal for hot oil lines, makes it unsuitable for throttling. And when a valve leaks, it doesn't necessarily mean that only the seat is at fault—that valve may be the wrong type for the service on which it is used.

In almost any service there is one valve that will perform better than any other. That is why the Crane Catalog lists thousands of valves—to assure your getting the one that exactly fits your requirements.

The problem, then, is how to pick the right one. As a matter of fact you, who know the actual conditions of your service, are in a better position than anyone else to select the valve you should use.

**Get This Valuable Guide Free**

To assist you in making this selection we have prepared a bulletin, "Service Characteristics of Globe Valves and Gate Valves," containing a useful chart designed to help you work out your requirements. It greatly simplifies your selection by showing the service characteristics of each type of valve. A copy of this valuable bulletin will be sent to anyone interested—mail the coupon below.

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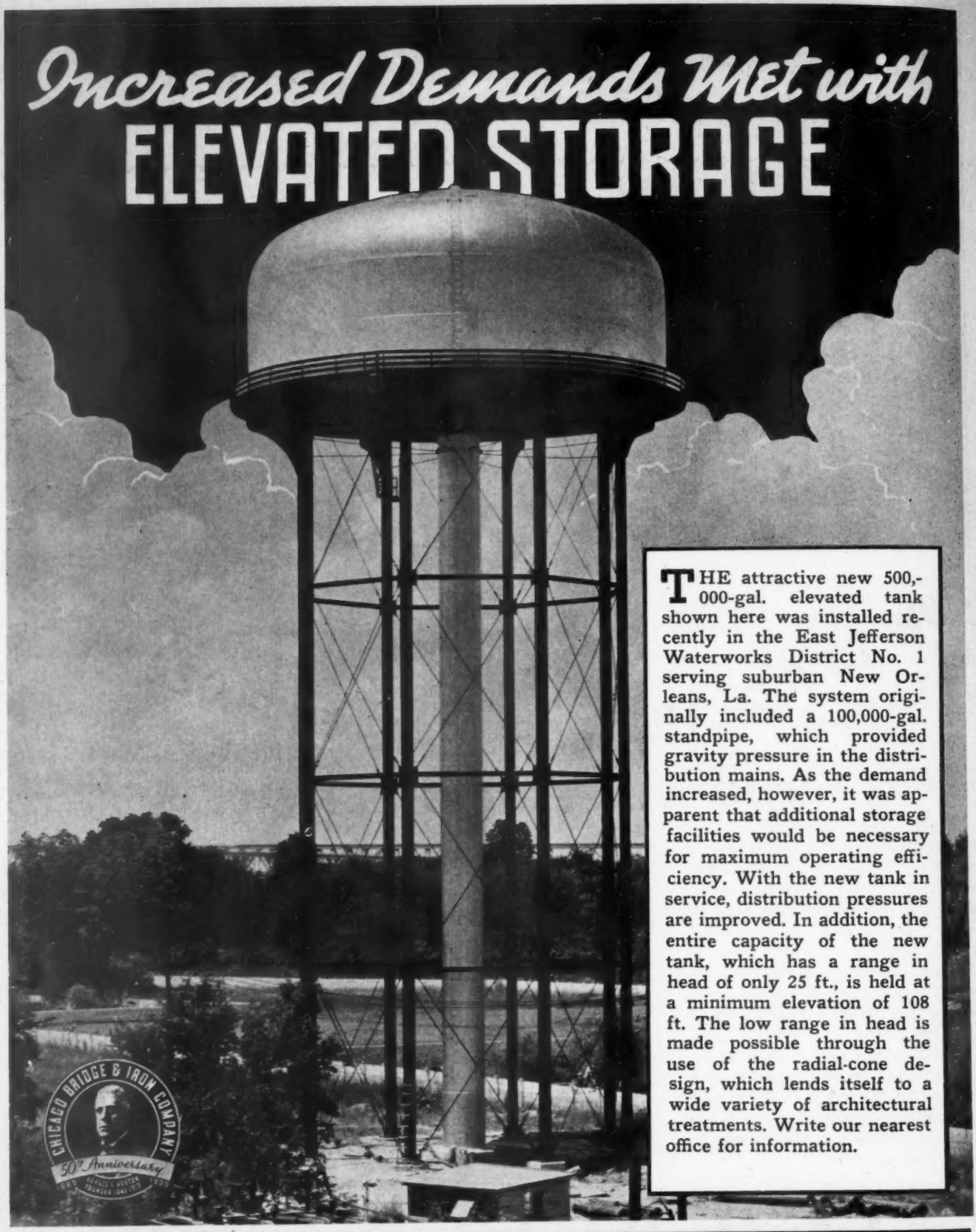
# *Increased Demands Met with* ELEVATED STORAGE




THE attractive new 500,000-gal. elevated tank shown here was installed recently in the East Jefferson Waterworks District No. 1 serving suburban New Orleans, La. The system originally included a 100,000-gal. standpipe, which provided gravity pressure in the distribution mains. As the demand increased, however, it was apparent that additional storage facilities would be necessary for maximum operating efficiency. With the new tank in service, distribution pressures are improved. In addition, the entire capacity of the new tank, which has a range in head of only 25 ft., is held at a minimum elevation of 108 ft. The low range in head is made possible through the use of the radial-cone design, which lends itself to a wide variety of architectural treatments. Write our nearest office for information.

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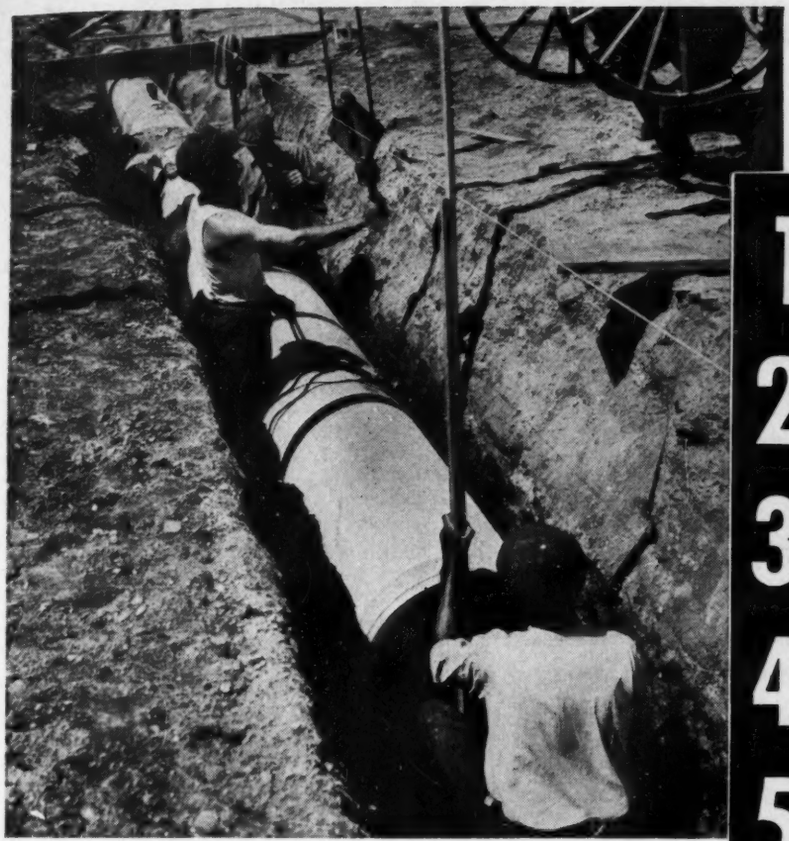
| Cleveland | 2262 Rockefeller Bldg. | Houston | 2919 Main Street | San Francisco | 1083 Rialto Bldg. |
| Dallas | 1479 Liberty Bank Bldg. | Detroit | 1551 Lafayette Bldg. | Los Angeles | 1455 Wm. Fox Bldg. |

*Fabricating plants in CHICAGO, BIRMINGHAM, and GREENVILLE, PA.*

# A 5-POINT SAVING IN SEWER-LINE COSTS



**TRANSITE'S LONG LENGTHS** facilitate laying pipe to accurate grades, speed up installation and reduce the number of joints in the line.

1. SHALLOWER TRENCHES
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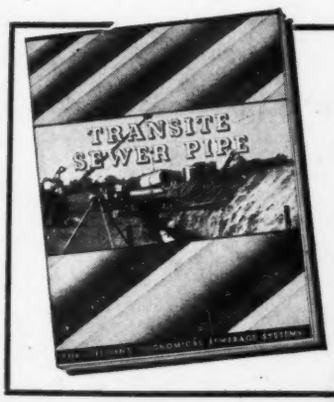
3. FEWER JOINTS
4. LESS INFILTRATION
5. LOWER MAINTENANCE COSTS




**WRITE FOR YOUR FREE COPY OF THIS NEW BROCHURE**

LOOKING for lasting sewer-line savings? Check the advantages of J-M Transite—the asbestos-cement sewer pipe. You'll see how this modern material provides important savings on all the above points.

In municipal sewer systems, Transite's high flow coefficient, tight joints, corrosion resistance and uniform strength are establishing a new standard for efficient, economical service.

The facts about J-M Transite Pipe are interesting and convincing. You should have full details before planning new sewer lines or modernizing old ones. Write for Sewer Pipe brochure, TR-21A, to Johns-Manville, 22 E. 40th St., New York, N. Y.

## Johns-Manville TRANSITE PIPE

***THE MODERN MATERIAL FOR SEWER AND WATER LINES***

# *Quiz* . . . for waterworks men . . .

During the past year, progress in the understanding of palatability control has emphasized several questions of more than usual interest to waterworks men. Test yourself on the three questions printed here!

***Question*** . . In your plant, what is your average odor reduction load?

***Question*** . . How much odor reduction do you obtain by aeration, coagulation, and filtration?

***Question*** . . How much of the total odor reduction load needs to be carried by activated carbon treatment?

**THE ANSWERS** to these and other important questions are found in Threshold Odor Surveys. These Surveys, first suggested by Darco Corporation, make possible a clear picture of the palatability control problem in your plant.

If you are not familiar with Threshold Odor Surveys and the Darcograph—write for full information today. We will also be glad to send you a sample of Hydrodarco* — the activated carbon specially made for water treatment.

*Reg. U. S. Pat. Off.

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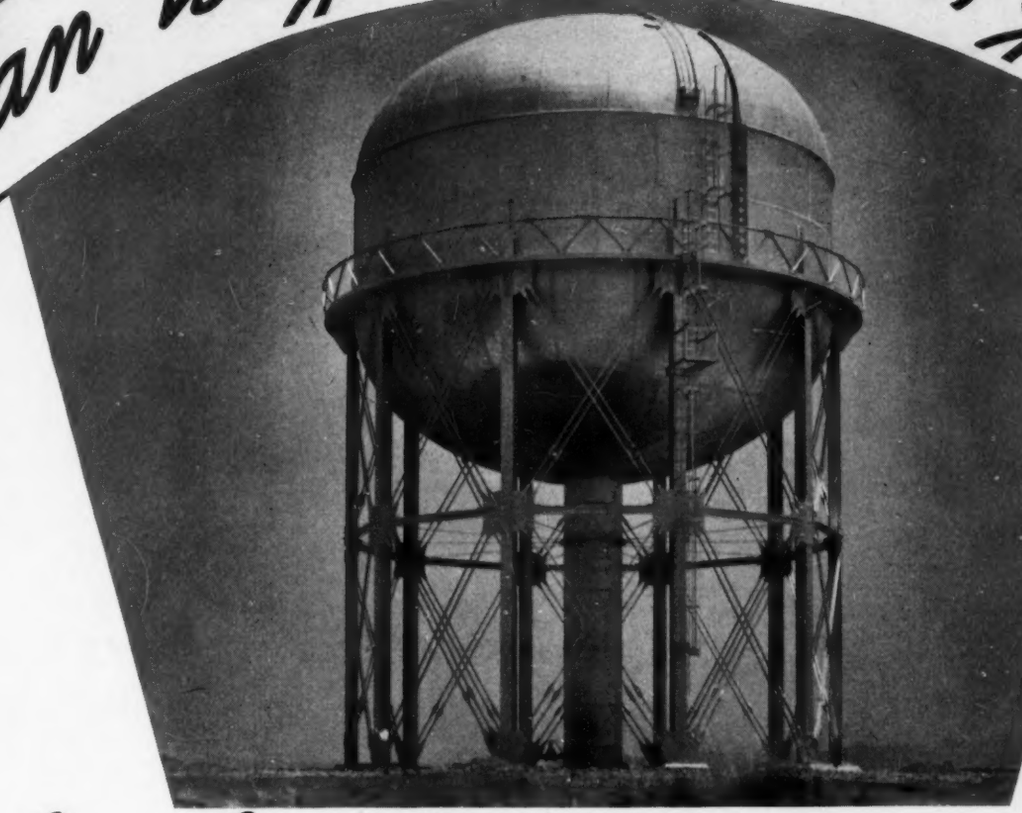
*San Diego, California, joins...*



*the long list of progressive communities*

**UTILIZING**

# P·DM ELEVATED TANKS

This handsome new 500,000 gallon P·DM Double-Ellipsoidal Elevated Steel Tank is an addition to the city of San Diego's water system that is thoroughly approved by the citizen who benefits by bettered service—who sees in it still another symbol of his city's progress—and particularly by the city officials who selected P·DM for the job.

The following comments by San Diego's supervising Hydraulic Engineer are typical of the satisfaction expressed regarding our tank installations, in unsolicited letters from hundreds of communities throughout the country:

"Personally, I wish to thank you and your Company for the splendid way in which the work was handled and the excellent tank that will be of benefit to a number of the citizens of San Diego for many years.

We have already received a number of favorable comments on both the tank and the additional water pressure resulting therefrom."

P·DM ALWAYS ON THE JOB

Let a Pittsburgh-Des Moines Engineer point the way to a better, more economical water supply for *your* municipality!

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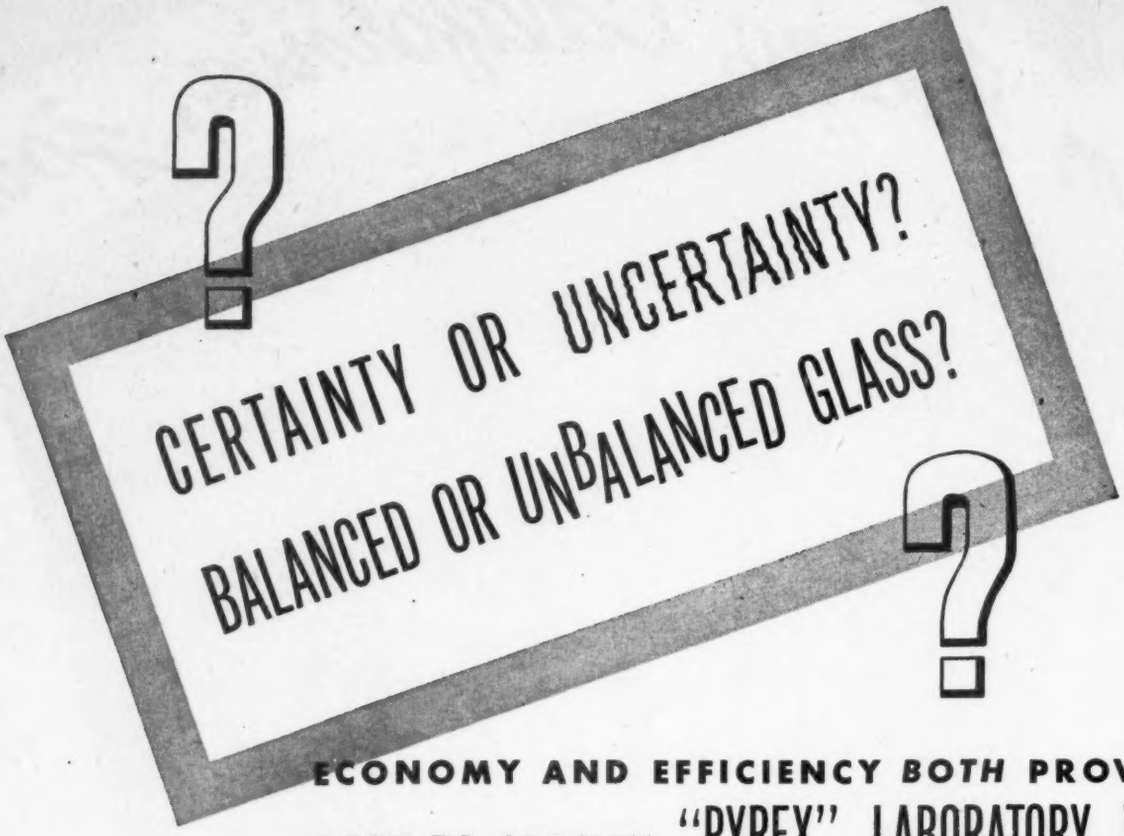


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**WITH** Balanced Glass you can be certain. Certain that your laboratory ware is mechanically strong, thermally safe, chemically stable. And you can be equally sure that its strength and its stability have been scientifically *balanced.* Each property of Balanced Glass is adjusted to every other property. None has been enhanced at the expense of another. All are combined for maximum value—for all-around use.

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## CORNING GLASS WORKS • CORNING, N. Y.

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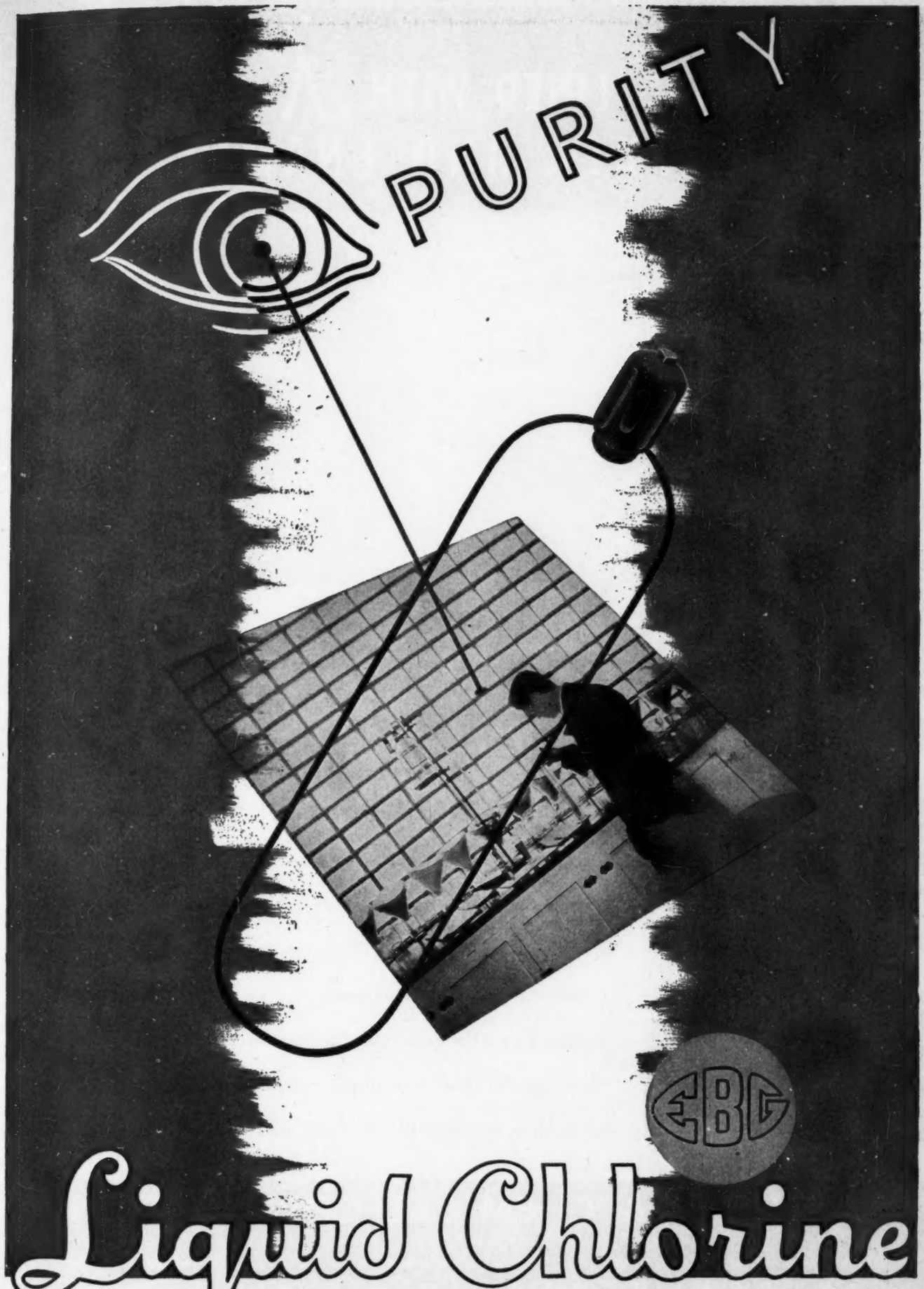
**VISIT THE GLASS CENTER AT THE 1939 NEW YORK WORLD'S FAIR**

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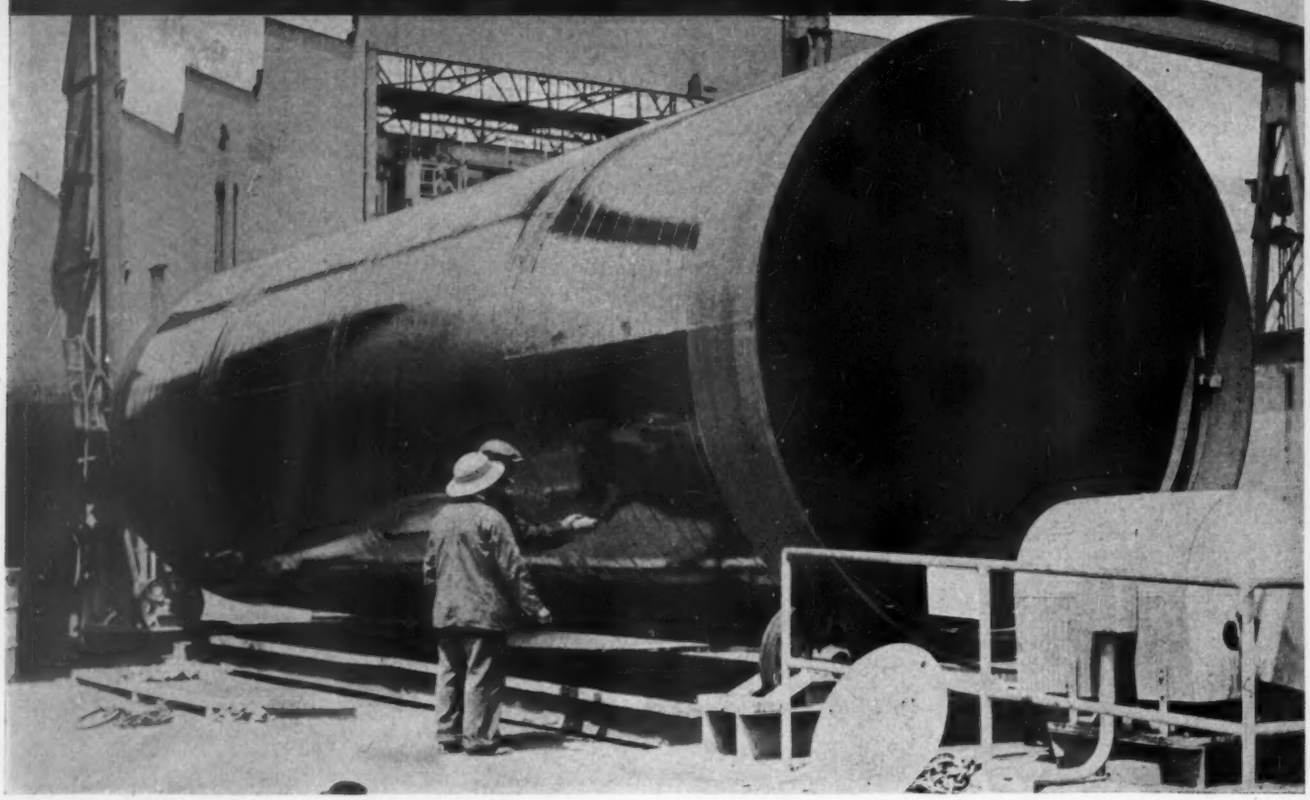
# COATED AND LINED WITH *Reilly* PIPE PRIMER AND ENAMEL



**REILLY PIPE PRIMER AND ENAMEL** provide safe and dependable protection of water mains, conduits and pipe lines of all sizes. No rusting nor corrosive agency can penetrate these coatings which are highly resistant to abrasion and unaffected by wide variations in temperature. Tuberculation is prevented and permanent "full capacity flow" is assured. For positive and permanent protection, specify **REILLY PIPE PRIMER** and **ENAMEL.**

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# WATER WORKS & SEWERAGE

*Published Monthly by Gillette Publishing Company*

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155 East 44th St., New York, N. Y.
L. H. Enslow, Editor

## COMING!

### *Articles*

**"Preparation of Water for Filtration"**
(Model scale studies of rapid mix and slow flocculation schemes; lead to plant installation, with benefits noted at Indianapolis.)

**"Some Interesting Developments in Sewage Treatment"**
(As recently observed in Holland, under guidance of Dr. Kessener.)

**"Relieving Partially Choked Air Diffusion Plates"**
(Routine application of chlorine gas to air header at intervals maintains porosity of plates; boosts operating efficiency and economy.)

**"Sewer Maintenance"**
(Operating and maintenance practices of America's largest privately owned sewerage company.)

**"Copper Sulphate Comes of Age in Water Treatment"**
(Most effective methods of handling and applying the algaecide, including continuous feeding.)

**"Watching the Cash Register"**
(The economic limits of meter maintenance for most profitable operation—the result of a study of facts vs. opinions.)

**"A Water Hammer Problem"**
(The successful correction of a common problem.)

**"Gas Engines for Sewage Plants"**
(Governing principles in economic analysis, design and specifications, operation and maintenance.)

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N. Y. State Dept. of Public Works

NORMAN C. WITTWER
Supervising Engineer
Rahway Valley, N. J. Treatment Works

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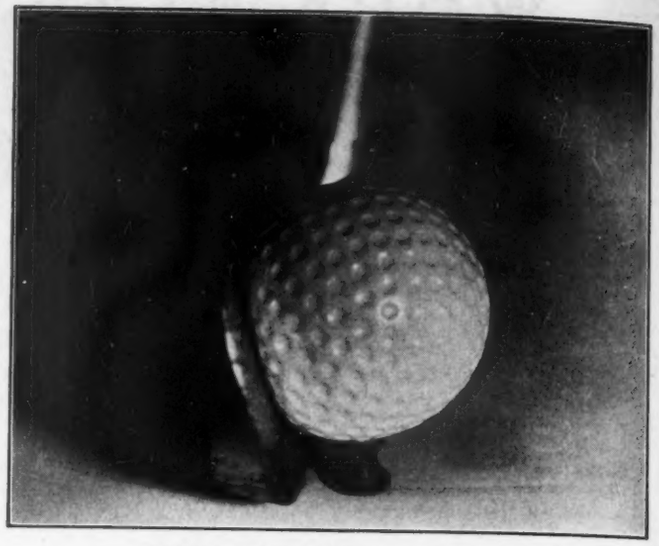
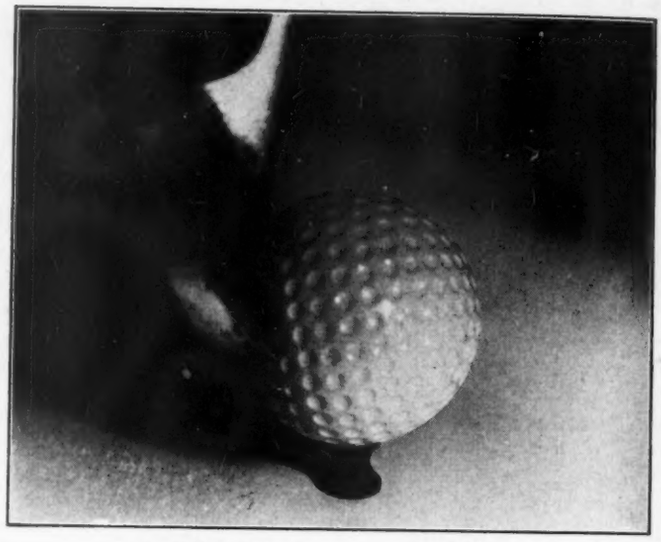
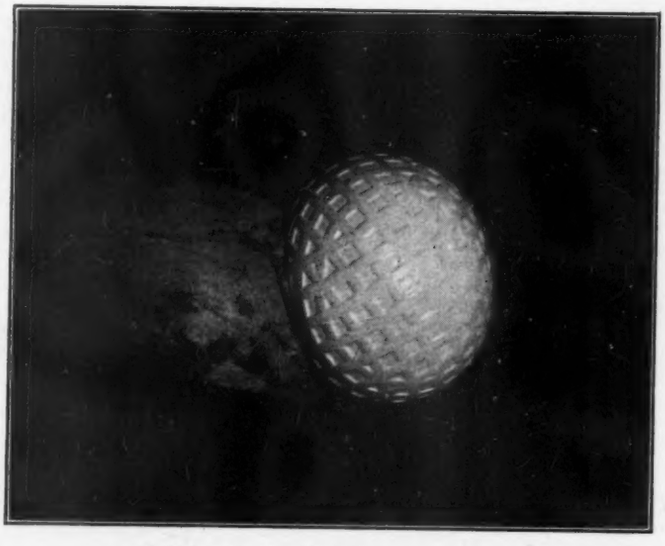


● IRON AT IMPACT



● "TOPPED"

*All Photos by Edgerton, Germeshausen & Grier Mass. Inst. of Tech.*



● DRIVER AT IMPACT

# WATER WORKS & SEWERAGE

VOLUME 86, NO. 4 *A Gillette Publication* APRIL, 1939


# SOFT WATER COMES TO THE CITY OF CLARKSBURG

## *Recent Additions to Purification Plant Involve Zeolite Softening*


**By SCOTLAND G. HIGHLAND**

**Water Board**

**CLARKSBURG, W. VA.**

**The Author**

THE water supply of the city of Clarksburg, West Virginia, is taken from the West Fork of the Monongahea river which has a catchment area of 385.48 square miles lying in the midst of the most extensive coal areas of West Virginia. There are many mines, some active and others permanently or temporarily abandoned in this rich coal producing area whose operation have affected very considerably the character of water in the river, and particularly at times of low flow.

### *Some History*

The original water plant was put in operation April 8, 1889, and some parts of it are still in use.

By unanimous vote of the city council on December 2, 1904, the water works plant and system was sold to foreign capitalists for $100,000. At that time the city council admitted it could not successfully operate the plant. Not a dollar of the $50,000 bond issue for the original construction of the plant had been paid or provided for and there was a large floating debt. Two weeks later, however, the council rescinded the sale upon petition of 1,201 citizens and taxpayers protesting against its action.

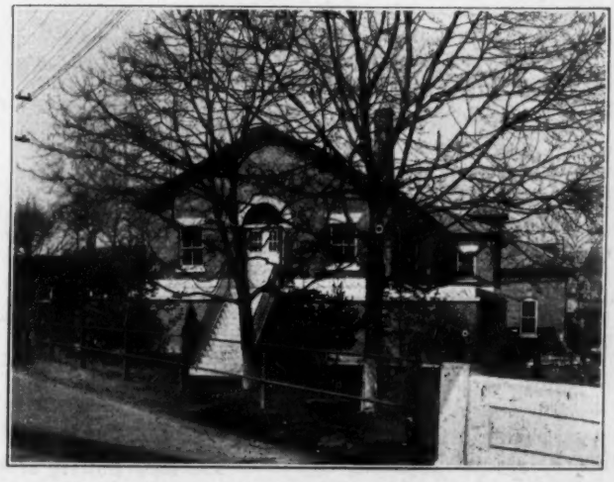
On January 28, 1909, the Clarksburg Water Board was created by a special act of the legislature, with the unanimous approval of the city council and all other citizens of the city, and was charged with the duty and responsibility of providing an ample supply of pure and wholesome water.

The Board was organized on April 19, 1909 and Mr. E. T. Weir, Chairman, National Steel Corporation, Pittsburgh, Pa., was elected its president. The present members of the Board are March L. Pritchard, president; and Patrick Henry Shields and John Ransel Romine, members. The writer has been associated with the department for more than thirty-three years, and has served as General Manager for twenty-seven years.

Under the control of the Clarksburg Water Board, the Department has been operated as an administrative entity, entirely divorced from the general city government in order to separate a vital service from constant partisan control. And, today the water works system of Clarksburg is valued at $2,300,000 in excess of its value 33 years ago.

The first step in purification of the river water was taken by the Board September 14, 1909, when the necessary funds became available for construction of the filter plant which was designed by the firm of Hering and Fuller consulting engineers, of New York City. The entire plant and system was revised and revamped and the coagulating basins and rapid sand filters were completed November 14, 1911.

In February 1919, further additions were begun, doubling the capacity of the filter plant. During the last eight years of business depression, the Board



**Main Entrance to Clarksburg's Plant. 1889 - 1939.**

**Chemical Tanks and Operating Floor of the Filter Plant.**
(*Built in* 1911, *enlarged* 1919.)

has appreciably extended and reinforced the distribution system and feeder mains; increased the raw storage by constructing the Highland dam; increased the pumping capacity and high level storage, including the covering of all high level reservoirs. Just recently it has completed a contract for removing the old steam equipment, adding filter capacity and a zeolite type of water softening plant.

All this work, costing more than $500,000, has been financed from current funds, without bond issues, federal or other outside aid. The Board has consistently reduced indebtedness on the property to the extent that bonds now outstanding amount to less than 2% of its appraised value of $2,370,000.

***Recent Improvements Involve Zeolite Softening***

On December 30, 1937, the Water Board authorized an expenditure for increasing the filter capacity and adding zeolite water softeners based upon the writer's recommendation. There is a certainty of future governmental flood control projects on the watershed increasing the storage and changing the character of the water. Increased operation and further development of the vast coal fields may be expected, because less than 3 per cent of the 2,511,478,090 tons of mineable coal has been removed. Accordingly it was felt that the utmost flexibility should be maintained in the design, making it possible at minimum cost to readjust the new installation for either increased filter or softener capacity as future developments may require.

From the standpoint of economy, also to maintain the harmonious appearance of the old plant and obtain a compact layout for convenient operation, along with the present filters, it was decided to make use of the old boiler house for housing the proposed installations. This decision was influenced by the fact that the steam equipment had not been in regular service since 1917 and was unnecessary; also that the general appearance of the plant would be decidedly improved by its removal, and particularly by eliminating the two steel stacks. The use of this old building to house the filters and softeners limited the layout to an area of 47 feet by 67 feet. As rock was present 8 feet below the old boiler room floor and the majority of the foundation walls were carried to it, it was possible to develop the necessary height in the old building for a filter and softener layout with some storage below and with assurance of excellent foundation conditions.

***Natural Greensand Zeolite Selected***

The layout in the old building includes a treated water basin of 80,000 gallons capacity, occupying the space below the filters and softeners with an entrance flume serving as a mixing chamber for the softened water and filtered water from either the old clear water basin or the new filters and new suction connections for the high service pumps located at the opposite end of the basin from the inlet flume. Above the basin along one side of the building are four open, gravity type, downward flow softener units filled with natural green sand zeolite. On the opposite side of the building are three similar sized sand filters—see cover picture.

Both filters and softeners are reinforced concrete boxes, 225 square feet net area and 10 feet 6 inches deep, with all pipe connections taken from the front or pipe gallery wall. A space of 9 feet 10 inches wide between the filters and softeners contains all piping and controls. The operating floor is of steel grating to give maximum light and ventilation in the pipe gallery, through which is a grating walkway with doors at each end giving access to other parts of the plant.

**The New Battery of Three 1 M.G.D. Filter Units and Four 1 M.G.D. Zeolite Softeners.**
*Gives Clarksburg the distinction of having America's largest municipally-owned Zeolite plant.*

The brine and sump pumps were installed at the end of the pipe gallery and the booster pumps in the machinery room basement of the old filter building. A new electric power service was brought in with a distribution panel and feeders to the pumping units and lighting system. It is interesting to note at this point that the lighting in the old building was by natural gas lamps and that all of the main pumps in the plant are driven by natural gas engines, operating most of the time on gas from the Water Board's own wells drilled in 1924. Natural gas unit heaters were installed for heating and ventilation.

In the new gallery a separate influent, effluent and wash water header for both the softeners and filters is provided. The two influent headers are interconnected at the end of the gallery with a separating valve. The influent to the softeners is connected to the venturi meter on the discharge lines of the booster pumping units. The influent to the new filters is cut into the main effluent line from the coagulating basins outside of the building and so valved that the water from the basins can be divided as desired between the old and new filters. The effluent from the softeners is discharged into the flume for mixing filtered and completely softened water before it enters the treated water basin under the new units. An air header is provided for the new filters and a brine header for the softener units. A common drain line serves both systems. The old filters equipped with air header is provided for the new filters and a brine factory service. Accordingly the piping from the old blower and the wash water pump is extended into the new gallery and connected up for use with the new filters. It is possible to operate the new filters and softening units entirely independently of the old filters.

***Why Zeolite Softening Was Chosen***

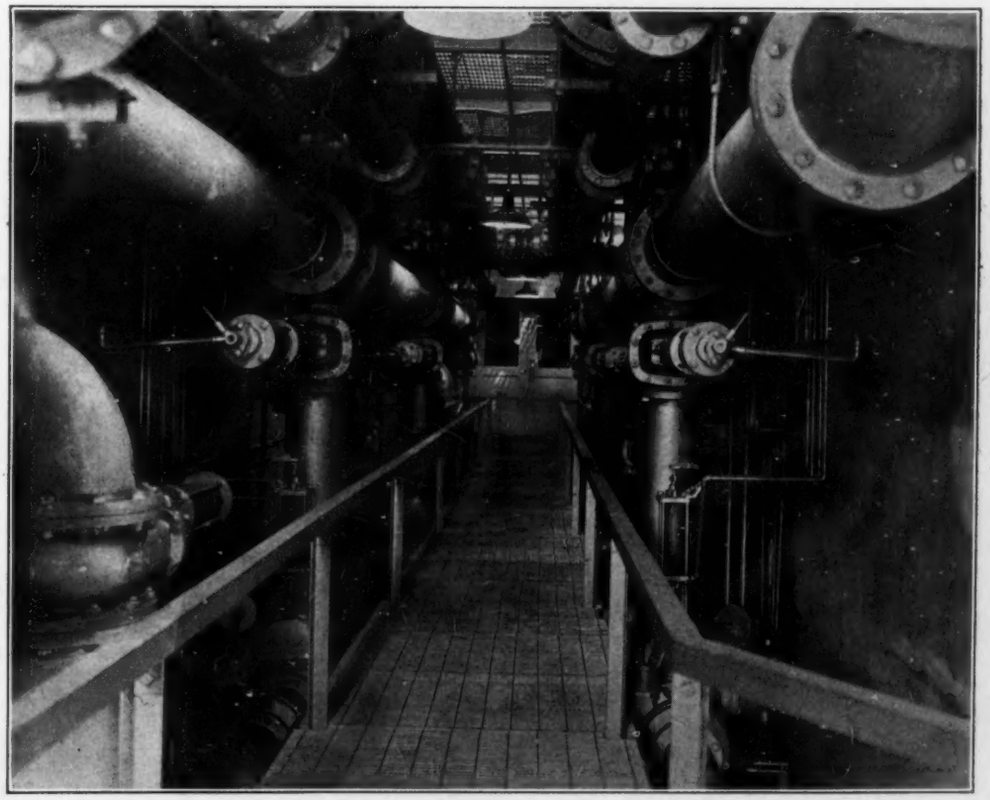
The plant laboratory records for the last few years show unusually wide variations for pH, turbidity and hardness of the river water, and indicate that to obtain a water with 70 to 80 parts per million of hardness will require at least six months of operation of the softeners each year, handling a water containing from 80 to 392 parts per million of hardness, chiefly in the form of calcium sulfate. Whether the hardness will be held below 80 parts per million will be determined by experience and the wishes of water patrons.

Because of this intermittent operation and widely fluctuating hardness, it was decided to use the gravity, down-flow type of softener units with natural greensand zeolite as the softening medium. The depth of the greensand is 66 inches giving a removal capacity of approximately 3,500,000 grains of hardness per unit, between regenerations. With interchangeability in mind and also the presence of an experienced crew accustomed to handling the older filter units, the operation and controls were made very similar to those in the old plant.

The records indicate that most of the time it would be advisable to filter the water prior to softening. Two variable speed, booster pumping units were installed to lift that portion of the water to be softened from the unsoftened filtered water reservoir through a venturi meter into the softener units. Because of the possibility of being able to operate during periods of low turbidity without previously filtering the water to be softened, the softener influent is also connected at the end of the gallery with the filter influent so that coagulated water direct from the coagulating basins can be fed from this bypass direct to the softener at will. The softener units and the new filter units each have a master control system.

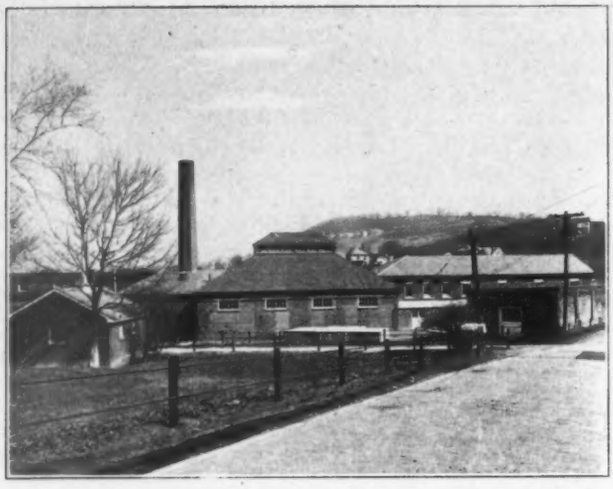
***Complete Softening and Fractional Mix***

The common method of softening part of the supply to zero hardness and remixing this with the unsoftened water to obtain a water of the desired hardness is used in this plant. When softening filtered water the rate is controlled by setting the variable speed booster pumps at the desired output. When softening unfiltered water the control is effected by manually setting the master control in the softeners to obtain the desired quantity. Control is so arranged that when set for automatic control the operator is only required to be sure that enough softeners are on the system to take the maximum quantity and to attend to the regeneration. The automatic master control operates through float units directly connected to the controller of each softener in such manner that the level on the softeners is



**The Pipe Gallery**

*Note grating floor of the operating gallery above and air and brine lines on either side.*



**The Back-Yard of Clarksburg's Plant (1889 - 1939).**
*Into the old boiler house, center foreground, went the new filters and zeolite units. The concrete bins show between the camera and the rejuvenated boiler room.*

maintained within a 24-inch range, regardless of the discharge of the booster pumps. The master control on the sand filters is a similar set of floats attached to the filter controllers and may be manually set at any desired elevation to give the total capacity desired through the new filter units. In addition, the influent to the filters has a separate high water automatic control which operates to protect the filters from overflowing under any condition. Such is necessary because of excess head from the coagulating basins.

***Salt and Brine Handling***

For regenerating the softeners there is a two-section salt storage building next to the plant railroad spur. Each section has sufficient capacity for a carload of salt and is connected into a small common brine manhole which houses the valves and gates controlling the water and brine lines. From this manhole a straight 4-inch Transite pipe delivers the brine to the brine pump located in a pit in the pipe gallery. The brine from this point is pumped into the header in the filter gallery where it is mixed with diluting water controlled by a mixing valve on the pressure system, and delivered to the brining systems of the individual softeners.

A small table on the upper operating floor level contains the starter for this brine pump, an extension handle of the cut-off valve for diluting water and the brine meter dial with an adjustable contact cut-off for the brine pump at any one determined quantity desired. There is an additional visible elevation gage in the basement enabling the operator to check the quantity of brine actually removed from storage.

The new zeolite softeners and filters were put into operation March 2, 1939, and the consumers are delighted with the softened water.

The total cost of the 4,000,000 g.p.d zeolite softening plant and the 3,000,000 g.p.d addition to the existing rapid sand filters was $93,889.85.

Perkins Boynton, chemist for the Water Board, will supervise the water softening plant in connection with his duties at the water purification works, without additional help.

Fuller & McClintock, consulting engineers of New York City, have been the engineers for the Clarksburg Water Board continuously since the first plant was built in 1910-1911, and have handled the work on this plant. The general contractor was the Patterson Engineering Company of Detroit, Mich. The manufacturers of the principal equipment in the plant follow:

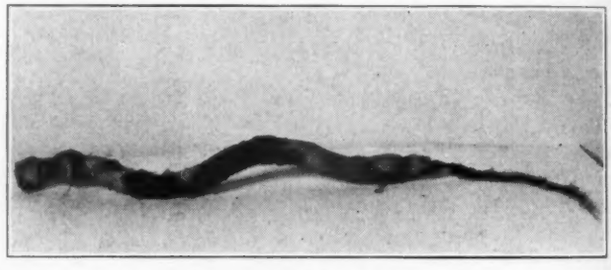
**Permutit Co.**—Zeolite.
**Simplex Valve & Meter Co.**—Meters and Controls.
**Allis-Chalmers Mfg. Co. and Yoemans Bros.**—Pumps.
**American Water Softening Co.** — Operating Tables.
**The Johns-Manville Corp.**—Transite Filter Underdrains, Troughs and Brine Distributors.
**Glamorgan Pipe & Foundry Co.**—Pipe and Fittings.
**Crane Co.**—Valves.

## "THE ROOT OF THE TROUBLE"

**By F. W. CHAPMAN***
*Greenwood, S. C.*

The accompanying photograph might properly be captioned "The Root of the Trouble."

Believe it, or not—this is a picture of what *was* an active service under a continuous normal pressure of 50 pounds for the past 7 years. However, from all appearances, this service could not have been overly "active" for some weeks before it was replaced with a new service connection.



**Root Service**

Responding to a complaint of low water pressure, it was found that the lead gooseneck was all but completely choked with a water-oak root. The root had penetrated a pin hole or crack at the point of the wiped joint and brass connection (on the left) and had gradually filled the pipe. Most phenomenally, the root had been able to push its way into the service against the 50 lbs. pressure. Possibly this is the tree which won for this species the soubriquet—*"Sturdy Oak."*

*Supt. of Public Utilities.

## A Simple Method of Purifying Air Reasonably

According to A .T. Masterman, in the *Journal of Industrial Hygiene,* spraying a solution of hypochlorites in concenerations of 0.14 grams per 1,000 cu. ft., odorless and practically sterile air was produced. During these experiments conducted in a room of people, none reported any discomfort. Sounds as if here is something worthy of note by sewage works operators and air conditioning engineers.

# GRIT CHAMBER VELOCITIES CONTROLLED BY PARSHALL FLUME

By STANLEY T. BARKER*
ALBANY, NEW YORK

THE problem of how best to control the velocity of flow through grit channels so as to perform their designed function of removing grit, without at times depositing organic solids with the grit, is one which has occupied the attention of many engineers.

In many of the older and larger treatment plants control of grit chamber velocity has been attained at rather large expense, by providing a considerable number of channels. Their operation involves manually varying the number of such in service so that the velocity through them approximates the desired figure of 1.0 foot per second. Another device which has been used is the proportional weir. This device permits the installation of fewer channels, but its deficiency lies in the excessive loss of head created.

Another important feature in sewage treatment works design has been the question of how to measure the flow to the plant. The decision as to how best to accomplish this has involved a considerable proportional expense in some plants when Venturi meters are used, or a relatively large loss of head if weirs or orifices are used. Also, the readings of weirs and orifices, when measuring sewage flows, are subject to inaccuracies caused by the deposition of sewage solids in the channel behind the measuring device, or by material catching on the weir crest or in the orifice.

*The Author*

## *The Parshall Flume a Worthy Device*

It appears that the relatively inexpensive combination of grit channels with a Parshall flume, which was devised by Mr. Glenn D. Holmes, consulting engineer of Syracuse, is worthy of especial consideration, since, by his arrangement of units Mr. Holmes accomplished both the accurate control of velocities in the grit channels and the accurate measurement of the sewage flow.

Mr. Holmes' first installation (described in the May 1933 issue of Water Works and Sewage) was made at the Newark, N. Y. sewage treatment works, where it has operated very satisfactorily since 1932. Similar schemes involving the Parshall flume are being installed in the Ley Creek sewage treatment works at Syracuse and the Plattsburg, N. Y. sewage treatment works, on both of which projects Mr. Holmes is the consulting engineer.

Having decided that he could substitute a Parshall venturi flume in the place of the less desirable proportional weir, Mr. Holmes determined that his combination of a Parshall flume and properly proportioned grit channels would provide both the desired close control of the velocity in the grit channel and also provide accurate measurements of flow. He further demonstrated that both of these

*Assistant Engr., N. Y. State Dep't. of Health.

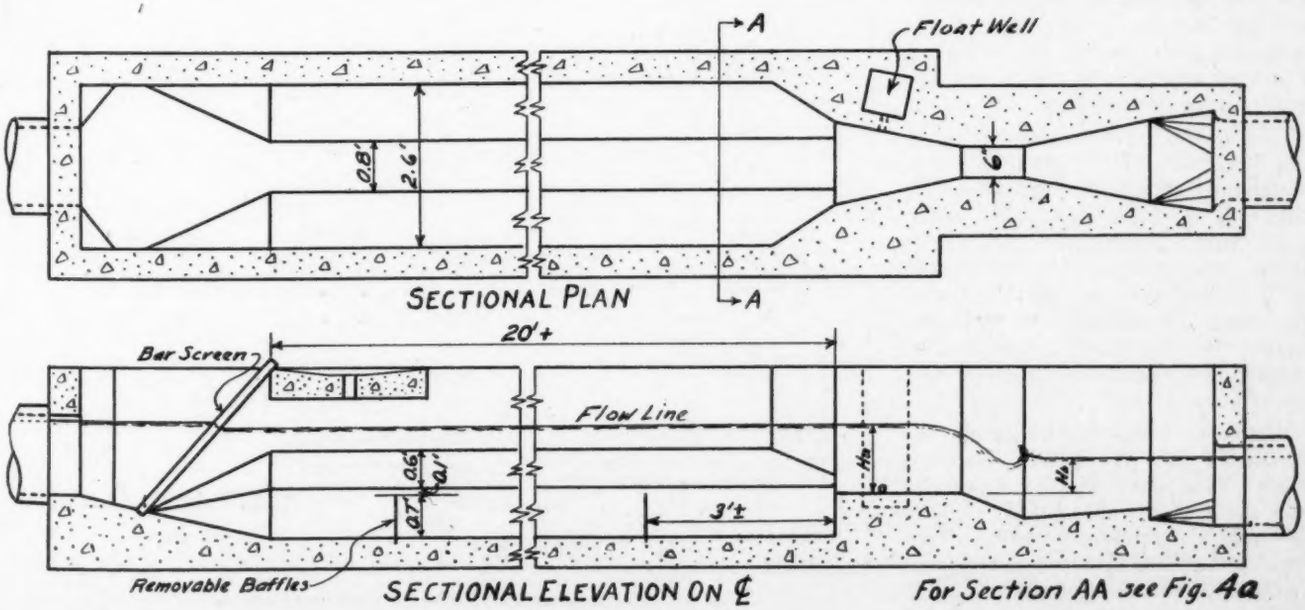



Fig. 1—Holme's First Parshall Flume.

**Table 1. Dimensions of Parshall Measuring Flumes.**
Letters refer to Fig. 2.

| Throat Width W | A ft. in. | ⅔A ft. in. | B ft. in. | C ft. in. | D ft. in. | E ft. in. | F ft. in. | G in. |
|---|---|---|---|---|---|---|---|---|
| 6" | 2-3⅞ | 1-4⅝ | 2-0 | 1-3½ | 1-3½ | 1-0 | 2-0 | 4½ |
| 9" | 2-10⅝ | 1-11⅛ | 2-10 | 1-3 | 1-10⅝ | 1-0 | 1-6 | 4½ |
| 12" | 4-6 | 3-0 | 4-4⅞ | 2-0 | 2-9¼ | 2-0 | 3-0 | 9 |
| 18" | 4-9 | 3-2 | 4-7⅞ | 2-6 | 3-4⅜ | 2-0 | 3-0 | 9 |
| 24" | 5-0 | 3-4 | 4-10⅞ | 3-0 | 3-11½ | 2-0 | 3-0 | 9 |

desiderata may be realized with a minimum loss of head and at relatively low construction costs. Two highly important design considerations in small plants particularly.

As a matter of interest it may be noted that such grit channel—Parshall flume combinations are being installed in a number of sewage treatment works which are being constructed in New York State during the current P. W. A. construction program. This article has been written with the thought that it may be helpful to other engineers if several suggested designs for these combinations are presented, with sufficient explanations so that modified designs may be developed to suit special cases.

### *Suggested Designs*

Figure 1 shows a schematic layout of a grit channel—Parshall flume combination embodying the ideas developed by Mr. Holmes at Newark. The bar screen or a comminutor, may precede the grit channel, or the comminutor or a mechanically cleaned bar screen may follow the flume if they are so installed and operated that the flow is never backed up sufficiently to submerge the flume to an extent which will affect its accuracy in measuring flow.

This question of submergence is very important if the flume is constructed as shown in Fig. 1 and 2, with only a single float well, since if the ratio between (Hb) and (Ha) at any rate of flow exceeds .50 for the 6" flume, .60 for the 9" flume, and about .70 for the 12" or larger flumes, the single-float type of registering device will not register the flow accurately.

Figure 3 gives discharge curves for 6", 9", 12", 18" and 24" Parshall flumes which are plotted from the data in Bulletin No. 423 of the Colorado Experiment Station. From the shape of the curves it is apparent that the discharge per unit of cross sectional area of the flume is greater for large depths in the flume than for the relatively shallow depths. Therefore, the width of the grit channel must *increase with the depth,* to allow for the larger rate of discharge.

### *Flume Dimensions*

For the convenience of engineers who may not have the above mentioned Parshall flume bulletin at hand, Fig. 2, which are Wittwer's reproduced from the July 1936 issue of Water Works and Sewerage, is here presented together with Table 1. These reveal the dimensions of the above sizes of flumes. The 18" flume is not a standard Parshall flume, and the dimensions and discharge values have been determined by interpolating between Parshall's values for 12" and 24" flumes. Since both the 12" and 24" flumes use the same free discharge formula, (in which the width appears to the first power), it seems entirely proper to conclude that the discharge of an 18" flume can be interpolated from the tabulated discharges of the 12" and 24" sizes.

It is felt that 6, 9, 12, 18 and 24 inch Parshall flumes cover the range of flows which need be considered, since if the flow is larger than can be measured properly by a 24" Parshall flume, the treatment plant is probably so large that some form of mechanically cleaned grit channels and grit washing device will be installed. And with the provision of grit washing equipment the accurate control of the velocity in the grit channels is not so important. However, there is nothing to prevent adapting this combination of a grit channel and Parshall flume to the use of mechanical equipment such as drag scrapers or the like.

### *Depth-Velocity Ratios*

Grit channel cross-sections have been designed for the above mentioned flume sizes and Table 2 shows the velocities that may be expected in the grit channels shown in Figs. 4 a, b, c, d and e, for the different depths in the flume and grit channels. The channel widths, and slopes of the side walls may be varied, of course, to produce other velocities if it should seem desirable to do so. The sloping walls may be continued to a greater width before beginning the vertical walls, if a very wide variation in flows is to be expected, but it is felt that the grit channels shown will provide for the usual ranges in flow in any usual sewage treatment works. In some cases, the width of the grit channels could be decreased without seriously affecting their performance. This, the designer can decide from a study of Table 2.

Of course, a theoretically perfect channel section would have curved side walls, but these would be ex-

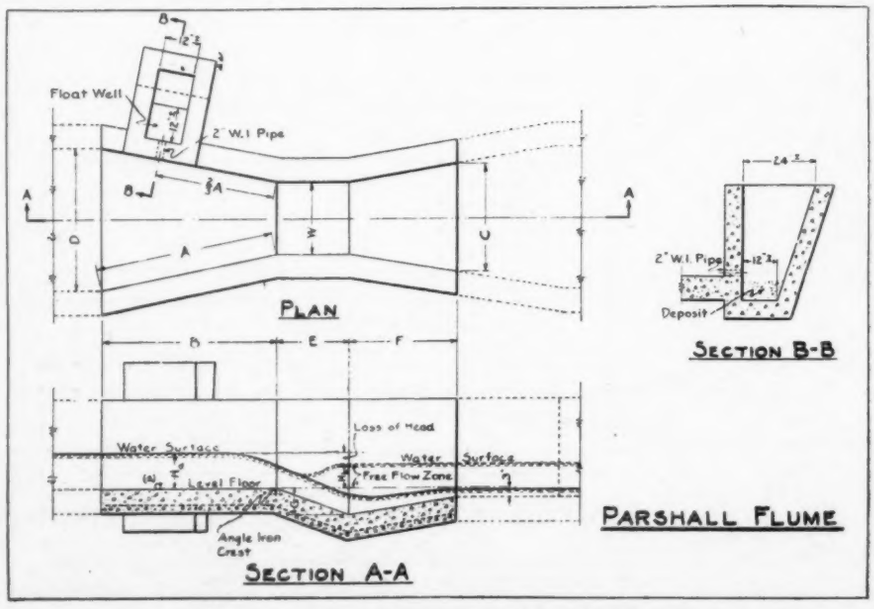



**Fig. 2—Parshall Flume in Plan and Section**
*(From "The Parshall Flume and Its Application to Sewage Works" by Norman C. Wittwer—W. W. & S., July, 1936)*

pensive to construct and it is felt that cross-sections similar to those shown in the suggested designs will be much more satisfactory to construct, and will give velocities close enough to the desired figure of 1 foot per second to accomplish the intended purpose.

### *Flexibility and Economy*

For a sewage treatment works with a 6" flume and where the sewage is supposed to contain no storm water, a single grit channel is usually satisfactory and adequate, but where the flow requires a 9" flume or larger, it may be desirable to have at least two channels. Fig. 4b shows a suggested design to be used with a 9" flume, and if two channels are provided and used alternately, each should be of the size shown. However, a more economical design would be to divide the cross sectional area shown in Fig. 4b between two channels, each having vertical dimensions equal to those in Figure 4b but with horizontal dimensions half o fthose shown. This would permit steepening the slope of the side walls. Such will be desirable, in that it will lessen construction costs and decrease the possibility of grit or debris lodging on the sloping walls and having to be squeegeed to the sump.

The slope of the side walls of the grit channel shown in Fig. 4b is 1½ on 1, and single channels for the larger flumes would have side wall slopes as flat as 2 or 3 on 1, so for this reason alone it is desirable to provide two or more channels for use together, so as to make it possible to keep the slopes down to approximately 1 on 1.

With a single grit channel, the plant operator would have to scrape the grit from below the flowing sewage, but this should not be a severe hardship at a small plant where the quantity of grit is not great. Of course, if the grit is expected to be deposited in large amounts, two or more channels should be provided at even the smallest plants so they can be put out of service alternately for cleaning. Where the two channels are designed to be in service at the same time, one can be placed out of service for cleaning at an off-peak hour, even though the velocity through the other channel would be somewhat excessive at that time.

In the case of plants requiring 12" or 18" flumes it would seem necessary to install at least two grit channels for continuous service and the cross-sections shown in Figure 4c & d are suggested. And for a flow requiring a 24" flume it would seem advisable to install 3 channels for continuous use, which would then have the dimensions shown in Figure 4e.

TABLE 2

*Discharge and Velocity in Grit Channels Having Dimensions Shown in Fig. 4*

| Depth in Flume | 6" Flume | | 9" Flume | | 12" Flume | | 18" Flume | | 24" Flume | |
|---|---|---|---|---|---|---|---|---|---|---|
| | M.G.D. | ft/sec | M.G.D. | ft/sec | M.G.D. | ft/sec | M.G.D. | ft/sec | M.G.D. | ft/sec |
| 0.1 ft. | .03 | .63 | .06 | .60 | — | — | — | — | — | — |
| 0.2 | .10 | .91 | .16 | .83 | .23 | .75 | .33 | .70 | .43 | .65 |
| 0.3 | .21 | 1.03 | .32 | .96 | .41 | .86 | .61 | .80 | .80 | .73 |
| 0.4 | .31 | 1.06 | .49 | 1.04 | .64 | .93 | .94 | .89 | 1.25 | .85 |
| 0.5 | .45 | 1.08 | .68 | 1.07 | .90 | 1.00 | 1.21 | .96 | 1.77 | .91 |
| 0.6 | .60 | 1.08 | .91 | 1.10 | 1.19 | 1.03 | 1.77 | 1.00 | 2.34 | .96 |
| 0.7 | .76 | 1.06 | 1.15 | 1.12 | 1.51 | 1.07 | 2.25 | 1.03 | 2.98 | 1.00 |
| 0.8 | .94 | 1.07 | 1.41 | 1.13 | 1.84 | 1.09 | 2.76 | 1.06 | 3.66 | 1.03 |
| 0.9 | 1.13 | 1.08 | 1.69 | 1.13 | 2.21 | 1.10 | 3.30 | 1.08 | 4.70 | 1.05 |
| 1.0 | 1.33 | 1.10 | 1.99 | 1.13 | 2.59 | 1.11 | 3.88 | 1.09 | 5.18 | 1.07 |
| 1.1 | 1.56 | 1.12 | 2.30 | 1.13 | 2.99 | 1.11 | 4.49 | 1.10 | 5.99 | 1.08 |
| 1.2 | 1.78 | 1.14 | 2.62 | 1.12 | 3.42 | 1.12 | 5.14 | 1.11 | 6.87 | 1.10 |
| 1.3 | — | — | 2.98 | 1.12 | 3.85 | 1.12 | 5.82 | 1.11 | 7.77 | 1.10 |
| 1.4 | — | — | 3.33 | 1.11 | 4.32 | 1.13 | 6.42 | 1.12 | 8.72 | 1.10 |
| 1.5 | — | — | — | — | 4.79 | 1.12 | 7.25 | 1.12 | 9.71 | 1.11 |
| 1.6 | — | — | — | — | 5.29 | 1.12 | 8.02 | 1.12 | 10.75 | 1.11 |
| 1.7 | — | — | — | — | 5.80 | 1.12 | 9.11 | 1.12 | 11.80 | 1.12 |
| 1.8 | — | — | — | — | 6.33 | 1.12 | 9.61 | 1.12 | 12.90 | 1.12 |
| 1.9 | — | — | — | — | 6.87 | 1.12 | 10.45 | 1.12 | 14.05 | 1.12 |
| 2.0 | — | — | — | — | 7.43 | 1.12 | 11.32 | 1.12 | 15.17 | 1.12 |

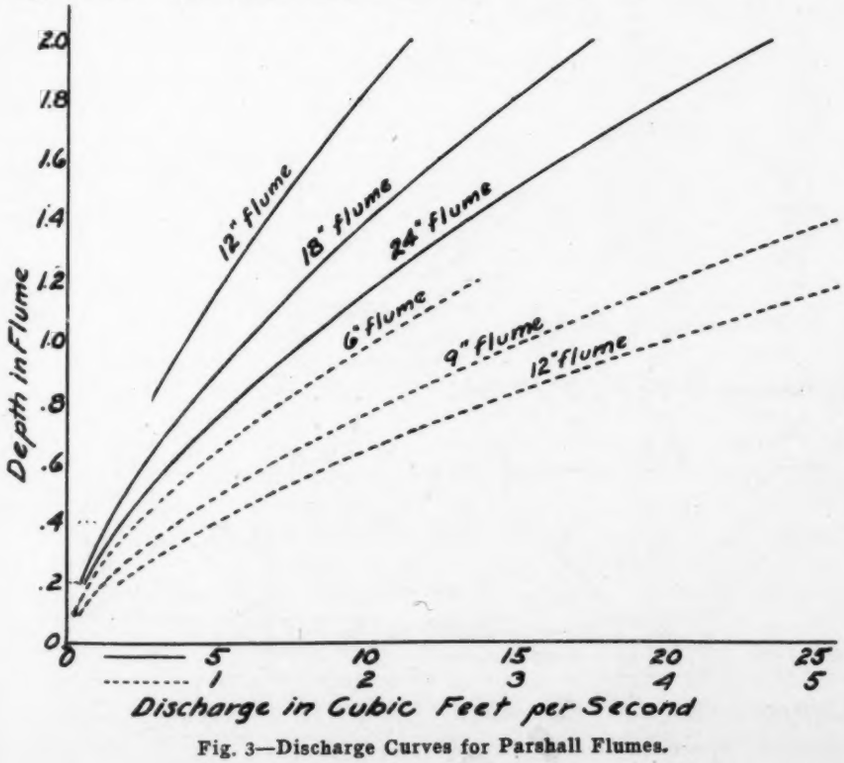



Fig. 3—Discharge Curves for Parshall Flumes.

### *Depth and Length of Sump*

If, for any reason, the plant is designed so the two channels are to be operated alternately, the approach to the flume should be given consideration and a long enough approach channel provided so the flow will enter the flume in a reasonably straight line and not pile up on one side of the upstream channel of the flume.

The depth of the grit sump will be governed by the designer's idea of the quantity of grit that may be expected, but for plants where the flow is supposed to contain no storm water an 8" or 12" depth of sump should be adequate.

Similarly, the decision as to what length of grit channel to provide

requires considerable judgment as to the amount of grit to be expected, but it would appear that in a small plant treating supposedly only sanitary sewage a length of 20 feet is sufficient. In the larger plants having a normal depth of flow in the grit channels of 1 foot or more, lengths of 30 to 40 feet would seem to be necessary to take out all the grit which is coarse enough to be troublesome.

Of course, in larger plants handling sewage from combined systems, and where the depths of flow in the channels are relatively great, the commonly used length of 60 feet may be justified.

To keep the grit sump from serving as part of the flowing through compartment, with the consequent effect of reducing the actual velocities through the grit channel. Mr. Holmes provided a grating with a relatively wide spacing of bars between the flowing through compartment and the sump, as shown in Figure 5. It is stated that this arrangement works satisfactorily at Newark. Another suggested method of accomplishing the same end is to provide removable metal baffles at intervals, across the grit sump as shown in Figure 1.

### *Why Grit Chambers?*

The question may arise as to the reason for installing a grit removal channel in a sewage treatment works treating sewage only from a sanitary sewer system. Experience with a number of sewage treatment works receiving supposedly sanitary sewage has demonstrated that sand and

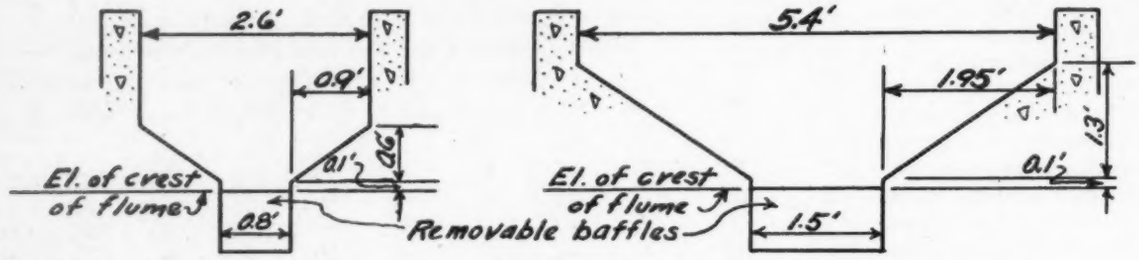



Fig.4a Single Grit Channel for 6" Flume

Fig.4b Single Grit Channel for 9" Flume

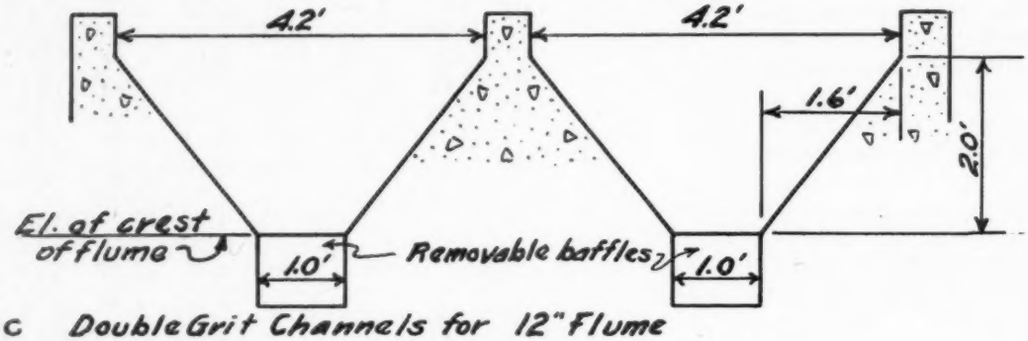



Fig.4c Double Grit Channels for 12" Flume

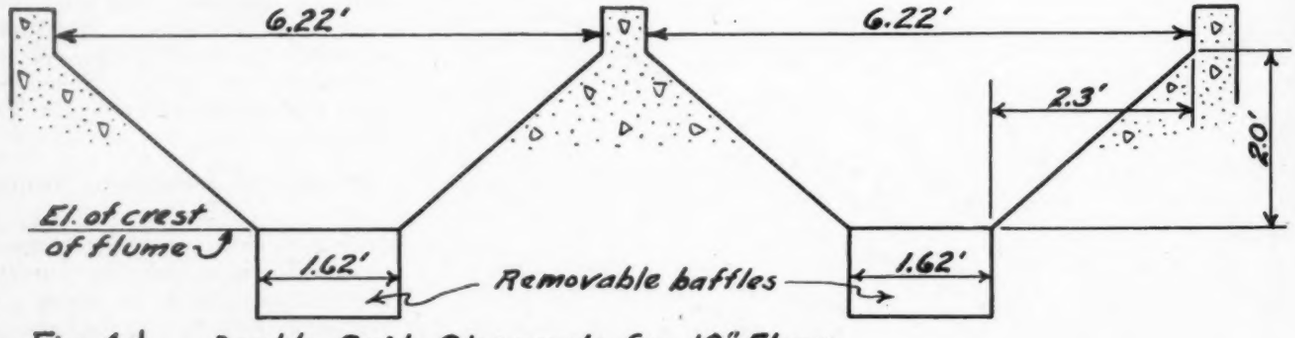



Fig.4d Double Grit Channels for 18" Flume

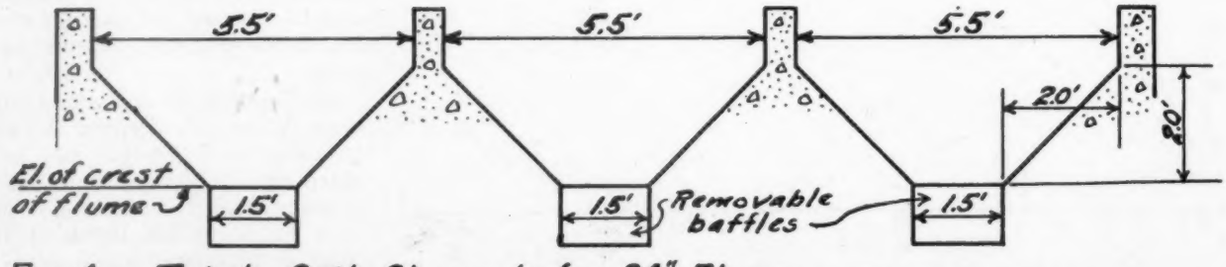



Fig.4e Triple Grit Channels for 24" Flume.

**Fig. 4—Suggested Dimension Details for Grit Channel Designs.**

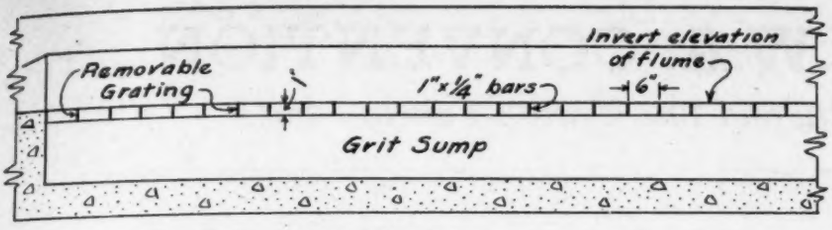



**Fig. 5—Sump Design Beneath Channel at Newark, N. Y.**
*(Note removable bar grate separation of channel and sumps.)*

grit more or less frequently gets into sewer systems, and has proved hard on pumps and very undesirable in causing sludge to pack and refuse to move from digestion units.

If a grit chamber were a very expensive device it might be left out of original design and added later if grit subsequently appeared in the sewage in objectionable amounts, but, since the above type of grit channels can be provided at so small a cost, it is felt that they should be more universally employed in the original design. In addition to grit removal, the dual function of your flow measurement is provided by such units.

# ON POURING COMPOUND JOINTS

## *"So Simple to be So Important"*

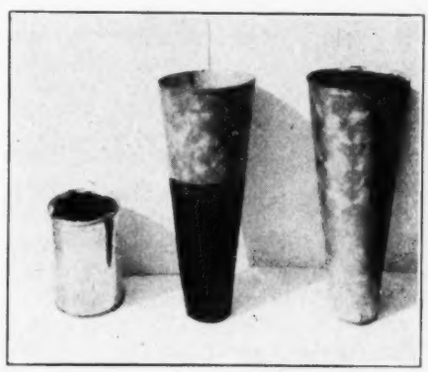
**By D. R. TAYLOR**
**Plant Supt., Roanoke Water Dept., Roanoke, Va.**

Dear Bill:

I certainly enjoyed your letter last week, enclosing the name and address of the manufacturer of the pressure-switch with the electrial surge snubber. We are installing a new 275,000 gallon steel tank in one of our more "polite" residential sections, and the tank is to be served by a booster pump some distance away, and I believe that the pressure switch that you mentioned (with the impulse snubber) will really give us a smooth operating outfit without the usual grief caused by sudden changes in pressure.

Bill, I have been trying to get up enough nerve to tell you something since I was over to see you in June, when you were laying that twelve inch header across the south west section. It is just a little constructive criticism that I would like to pass along, and I am sure that you will take it just as it is intended, and by the same token I will appreciate any such criticism that you care to pass along to me.

When I was over to see you that day, I noticed that your men were using small tomato cans for pouring funnels. Bill, it is a recognized fact that in using joint compounds for jointing cast iron pipes you should have a funnel, (gate, or cup, whatever you may call it,) of such height that you get between seven and eight inches of head on the joint in order that there will be pressure enough to fill every void or crevice from the face of the bell all the way back to the jute, and also to reduce



the size of the bubble at the top of the joint caused by the air being forced out; and while you may not have ever seen it, Bill, there is a bubble there just the same.

In using a tomato can four inches high, you may rarely have a joint that leaks very badly, yet it is not the proper way to lay pipe, and you know, Bill, that in our profession we learn something every day. We are striving for perfection, and while we may still lack a lot in having reached that point, something "almost as good" you know is *not good enough* if we know how to do it better.

I was over to Walesburg for a few minutes yesterday to see Harry Wallersby. Harry was making a short six inch extension to catch another fire hydrant, and he was using some nice, new, shiny pouring funnels that he had recently bought, but he was only filling them half full. Well, Bill, you know by now that Harry might as well have used the tomato cans, because pouring his funnels only half full was giving him no better results, because in either case he had only four inches head on his melted compound.

We were pouring a few joints this morning, and with the realization that others might have missed the same simple idea, I poured three funnels and photographed them, a print of which I am enclosing herewith. Reading from left to right you first will see a four-inch tomato can poured full. In center is a regular pouring funnel poured half full. I have painted the bottom of this funnel to indicate the height to which it is filled with compound. The funnel on the extreme right is poured level full.

Well, Bill, the only excuse we had for using tomato cans was that they were easy to obtain at the incinerator or on a dump, and that they cost nothing, and the only reason for pouring the standard funnel half full was probably the idea we had that it might save time or save compound. But we were wrong on all counts.

Bill, there are a lot of little simple things like these that I know what I haven't noticed but probably you and others have, so shoot them to me. You know everyone doesn't get the same impression. This is illustrated by a story my uncle used to tell. He was walking up the village street one morning when he met a friend of his approaching him with a pistol in his hand. My uncle said, "John, what on earth have you been doing?" His friend replied, "I just shot a dog up the street." My uncle said, "Was he mad?" His friend replied, "Well, he wasn't any too dern well pleased."

So you see, Bill, often times its just a case of a difference of opinion, and it is differences of opinion that keeps this old world turning and improving.

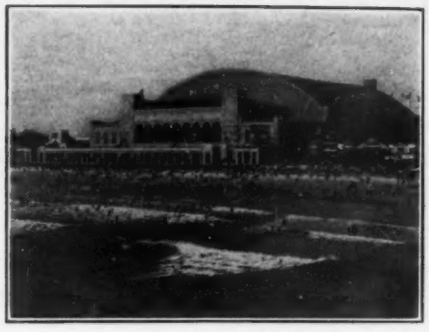
So — let's exchange some more experiences. I'll be waiting for your next letter, Bill.

Yours, etc.,
Tom

# THE A.W.W.A. CONVENTION

## *Atlantic City and The World's Fair in June*

Stretch of Boardwalk



The Auditorium

THE 1939 Annual Convention of the American Water Works Association has been planned so as to give those attending a "3 in 1" combination. From present indications the combination "package" is to bring to the 59th Convention the largest number of members and guests ever recorded in the history of A.W.W.A.

Because of its convention facilities and its proximity to the New York World's Fair, Atlantic City was selected as the 1939 Convention place. The material reductions in rail fares to New York City in connection with the World's Fair constitutes an additional advantage to all who plan to attend the Atlantic City Convention. Services of A.W.W.A. headquarters in arranging hotel accommodations for those planning to visit New York and the World's Fair following the Convention has proved a helpful and appreciated service to members. And, too, a special train has been arranged for by the Transportation Committee to take members and guests from Atlantic City to New York City on Friday, June 16th—the day after the close of the Convention.

### *Atlantic City Hotels*

In Atlantic City two of the finest adjacent hotels on the Boardwalk have been selected as headquarters—The Ambassador and the Chelsea—providing 900 rooms at rates within reach of all. The latter is due to the foresight of the Convention Committee in choosing dates (June 11th-15th) as late as permissible preceeding the seasonal rush of sea-shore business. For one person in a room the rates are $3.00 to $6.00 per day; double rooms range from $5.00 to $10.00. Then, only a step back from the ocean-front there are many smaller hotels with lower rates for any who may be on a closely budgeted trip. So, the question of hotel rates which some have feared because of the convention location on Atlantic City's far famed Board-Walk, need no longer prove a deterrent to those who must watch their convention expenses.

### *Convention Arrangements*

Fortunate is A.W.W.A. in having "Bill" Orchard in the driver's seat of the 1939 Convention Management Committee, and "Clint" Inglee directing the week's program of entertainment—much of which will be of a unique variety such as only the "World's Playground" can offer.

J. Hermann Smith, heading the Exhibit Committee reports that 80 firms have already requisitioned 11,000 square feet of floor area in the Atlantic City Auditorium, thus establishing a record in respect to numbers of exhibitors and space to be used. Due to the spaciousness of the Auditorium exhibitors will this year be able to spread out, show equipment to better advantage and thereby add attractiveness to the arrangement.

John Warde, with a well earned reputation for his handling of convention transportation matters, comes to bat again in 1939 with splendid plans for railroad and local convention transportation—including the World's Fair Special to New York at the close of the convention. L. D. Gayton, City Engineer of Chicago and W. V. Weir, Supt. St. Louis County Water Co., are heading local Committees in Chicago and St. Louis arranging for group travel from these two central points to Atlantic City. Suggested routes and schedules are outlined on the accompanying diagram. (For special rates to New York City, with a side trip to Atlantic City, and confirmation of schedules conecting with through sleeping cars to Atlantic City from St. Louis, Chicago, Cincinnati, Cleveland, Pittsburgh or points South or East, consult your local railway agent, or John S. Warde, 50 Church St., New York City, N. Y.)

### *Technical Program*

The Technical Program of the 1939 Convention is an outstanding one. Although it has not been officially released in complete form the following listing indicates the variety of topics planned to interest the greatest numbers of water works men.

Amongst the high-lights are to be found the following:

The Hon. Harry A. Moore, Governor of New Jersey, on "The Protection of a State's Water Resources."

Leo Wolman, on "Labor Relations in Water Works Plants."

Carl Chatters, on "Recovery from the Recovery Program."

Frank O. Wallene, leading a symposium on "Administrative Problems of Sewer Rentals and Joint Collection of Water and Sewerage Charges."

A Symposium on "Water Hammer and Its Control.'

Two papers on "Planning of Water Works Property Development and Budgets."

Progress Reports and discussion on "Electrical Grounding"; "Proper Charges for Private Fire Protection"; "Social Security for Water Works Men"; "Developing New Meter Specifications"; "Developing Distribution System Records"; "Cathodic Protection of Water Towers and Tanks."

## THE PROGRAM

### *General Session — Monday A.M.*

President's Address—Reeves Newsom
Social Security for Water Works Men—Dale Maffitt
Discussion—W. W. Brush
Proper Charges for Private Fire Protection—D. D. Gross
Discussion—John B. Winder
Labor Relations in the Water Works Plant—Leo Wolman
Progress in Electrical Grounding Research—C. F. Meyerherm
Discussion—Geo. A. Sampson

### *Management & Operation Div.—Monday P.M.*

Wholesale Cost of Water—C. E. Capen, Jr.
Water Quality Complaints and their Interpretation—W. C. Lawrence
Potential Health Hazards in Distribution of Water to Consumers—A. E. Gorman
A Safety Code for Water Works Distribution—W. E. Stanley, Jr.
Design of C. I. Pipe—Some New Conceptions—W .D. Moore

### *Purification Div. — Monday P.M.*

Committee Reports
Chloramination—F. W. Gilcreas
Methods of Determining Fluorides—A. P. Black
Specifications and Tests for Water Purification Chemicals—M. M. Braidech
Testing of Zeolites—C. P. Hoover
High Rate Treatment—N. J. Howard
Conditioning Methods to Inhibit Corrosion—W. F. Langelier
Activated Carbon Research—M. M. Braidech
Coordination of Methods of Water Treatment and Laboratory Control—G. D. Norcom
The Aging of Reservoir Water—Lee T. Purcell
Discussion—Arthur H. Pratt and Robert Spurr Weston
The Flavon Test for Residual Chlorine—F. W. Gilcreas
Discussion—George E. Willcomb

### *General Session — Tuesday A.M.*

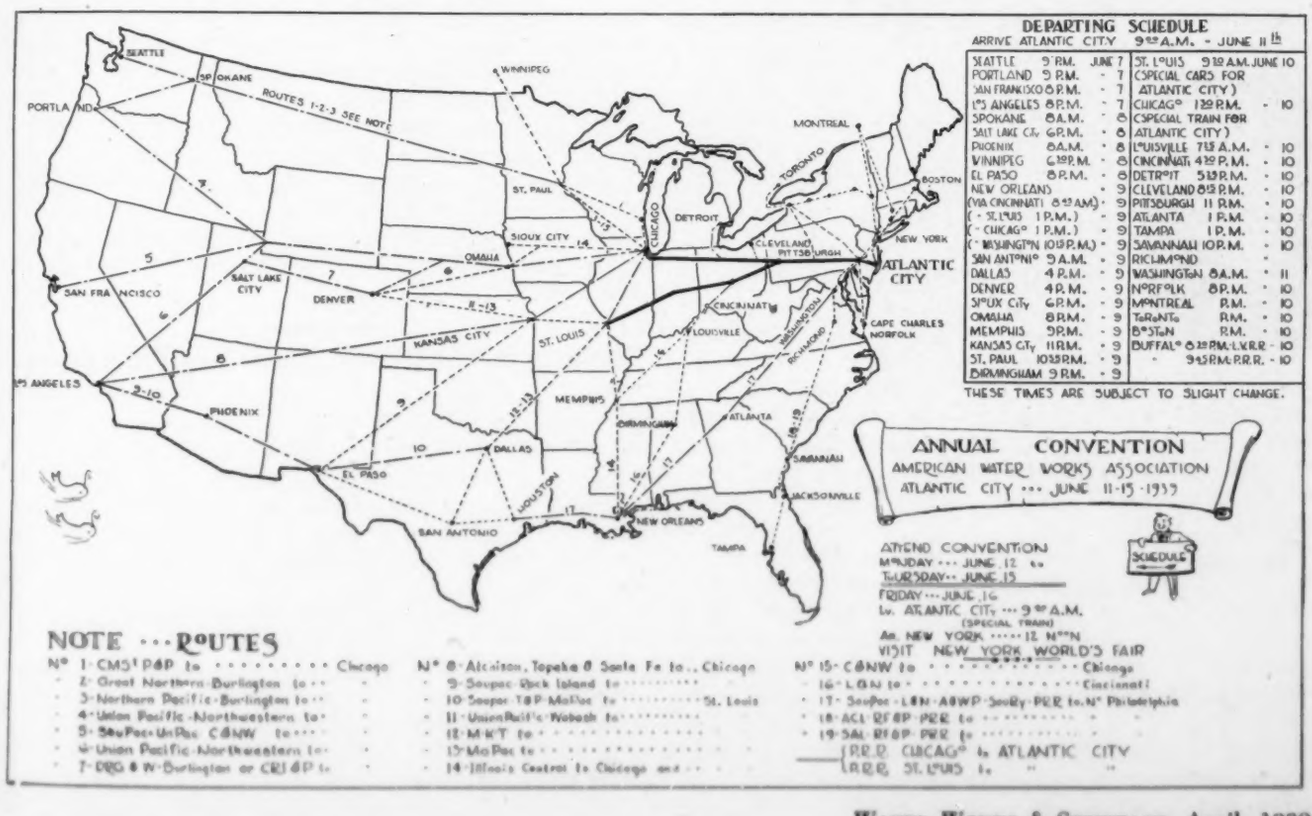
Earth Dams and Embankments—Wm. P. Creager
Discussion—F. A. Barbour
Protecting a State's Water Resources—Hon. A. Harry Moore
Water Supply Development in New Jersey—Geo. S. Burgess
Recovering from the Recovery Program—Carl H. Chatters

### *Purification Div. — Tuesday A.M.*

Fundamentals of Water Pre-Treatment—F. M. Bachmann
Discussion—Robert W. Furman
Experiences with the Coagulation of Soft Colored Water by Ferric Sulfate—Geo. E. Willcomb
Discussion—Elwood Bean
Experiences with Upward Flow, Short Period Sedimentation Basins—C. W. Klassen
Performance of Upward Flow Basins at St. Petersburg, Florida—R. H. Sawyer

### *General Session — Tuesday P.M.*

Methods for Determining Water Hammer Pressure—F. M. Dawson & A. A. Kalinske
Water Hammer Control in Long Pipe Lines—L. E. Goit
Water Hammer Control by Proper Valve Installation—E. C. Brisbane
Discussion of the Three Preceding Papers—Lewis H. Kessler—Vance C. Lischer


DEPARTING SCHEDULE
ARRIVE ATLANTIC CITY 9 A.M. - JUNE 11
SEATTLE 9 P.M. JUNE 7
PORTLAND 9 P.M. - 7
SAN FRANCISCO 8 P.M. - 7
LOS ANGELES 8 P.M. - 7
SPOKANE 8 A.M. - 8
SALT LAKE CITY 6 P.M. - 8
PHOENIX 8 A.M. - 8
WINNIPEG 6 P.M. - 8
EL PASO 8 P.M. - 8
NEW ORLEANS - 9
(VIA CINCINNATI 8 A.M.) - 9
(- ST. LOUIS 1 P.M.) - 9
(- CHICAGO 1 P.M.) - 9
(- WASHINGTON 10 P.M.) - 9
SAN ANTONIO 9 A.M. - 9
DALLAS 4 P.M. - 9
DENVER 4 P.M. - 9
SIOUX CITY 6 P.M. - 9
OMAHA 8 P.M. - 9
MEMPHIS 9 P.M. - 9
KANSAS CITY 11 P.M. - 9
ST. PAUL 10 A.M. - 9
BIRMINGHAM 9 P.M. - 9
ST. LOUIS 9 A.M. JUNE 10
(SPECIAL CARS FOR ATLANTIC CITY)
CHICAGO 1 P.M. - 10
(SPECIAL TRAIN FOR ATLANTIC CITY)
LOUISVILLE 7 A.M. - 10
CINCINNATI 4 P.M. - 10
DETROIT 5 P.M. - 10
CLEVELAND 8 P.M. - 10
PITTSBURGH 11 P.M. - 10
ATLANTA 1 P.M. - 10
TAMPA 1 P.M. - 10
SAVANNAH 10 P.M. - 10
RICHMOND -
WASHINGTON 8 A.M. - 11
NORFOLK 8 P.M. - 10
MONTREAL P.M. - 10
TORONTO P.M. - 10
BOSTON P.M. - 10
BUFFALO 8 P.M. L.V.R.R. - 10
9 P.M. P.R.R.
THESE TIMES ARE SUBJECT TO SLIGHT CHANGE.
ANNUAL CONVENTION
AMERICAN WATER WORKS ASSOCIATION
ATLANTIC CITY ••• JUNE 11-15 1939
ATTEND CONVENTION
MONDAY ••• JUNE 12 to
THURSDAY ••• JUNE 15
FRIDAY ••• JUNE 16
Lv. ATLANTIC CITY ••• 9 A.M.
(SPECIAL TRAIN)
At NEW YORK ••••• 12 NOON
VISIT NEW YORK WORLD'S FAIR
SCHEDULE
NOTE ••• ROUTES
N° 1 CMStP&P to ••••••••• Chicago
2 Great Northern-Burlington to •••
3 Northern Pacific-Burlington to •••
4 Union Pacific-Northwestern to •
5 SoPac-UnPac C&NW to •••
6 Union Pacific-Northwestern to •
7 DRG & W-Burlington or CRI&P to
N° 8 Atchison, Topeka & Santa Fe to ... Chicago
9 Soupac-Rock Island to •••••••
10 Soupac T&P-Mopac to ••••••••• St. Louis
11 UnionPac's-Wabash to •••••••••
12 MKT to •••••••••••••••
13 MoPac to •••••••••••••••
14 Illinois Central to Chicago and •••
N° 15 C&NW to ••••••••••• Chicago
16 L&N to •••••••••••••• Cincinnati
17 SouPac-L&N-ACWP-SouRy-PER to N° Philadelphia
18 ACL-RF&P-PER to ••••••••••
19 SAL-RF&P-PER to ••••••••••
PRR CHICAGO to ATLANTIC CITY
LRRR ST. LOUIS to " "

Vertical Pump Applications—Jule H. Coffey
*Round Table*:
On Specifications for Deep Wells and Deep Well Pumps
Discussion led by—Jas. C. Harding—J. A. Carr

### *Finance and Accounting Div. — Tues. A.M.*

Symposium on the Activities of the National Association of Railroad and Utilities Commissioners.
Standard Methods of Filing Rate Schedules—M. F. Hoffman
Standard Classification of Accounts and Standard Test of Retirement Units—L. D. Blum
Commission Jurisdiction over Water Works—Jacob Schwartz
The Accounting Manual—A Round Table Leader—F. R. Mills

### *General Session on Accounting — Wed. A.M.*

Service Lives of Water Mains—Reeves Newsom & E. H. Aldrich
Inspection Methods for Determining Pipe Condition—K. H. Logan
Discussion of the Two Preceding Papers by Elson Killam
Planning the Water Works Budget—J. P. Schwada
Planning Water Works Property Development—C. J. Alfke
Discussion by—Scotland Highland—Roger Esty
Administrative Problems of Joint Collection of Water & Sewage Charges—F. O. Wallene

### *Purification Div. — Wed. A.M.*

*A Symposium on Water Quality*
General Statement—G. D. Norcom
Standards of Raw and Treated Water Quality—H. W. Streeter
Waterborne Gastro-Enteritis—C. R. Cox
Chlorine Resisting Bacteria—Max Levine
Effective Residual Chlorine—F. C. Schmelkes

### *General Session on Purification—Thurs. A.M.*

Further Notes on C. I. Pipe Tuberculation and its Control—Thos. H. Wiggin
The Correlation Between the Carbon Dioxide and Mineral Content of Water and Its Corrosivity—Willem Rudolfs & T. T. Wong
The Threshold Treatment of Municipal Water Supplies
Discussion—H. O. Hartung
—E. P. Partridge
Super-Chlorination Practice in North America—H. A. Faber
Recent Experiences with Carbonaceous Zeolites—S. B. Applebaum

### *Finance and Accounting Div. — Thurs. A.M.*

Recent Decisions and Rulings Concerning Water Works—John Murdoch
Water Bills as a Lien against Property—H. L. Meites
The Inquiring Customer—A Dialogue Between Thad Erwin & M. F. Hoffman
Increasing Efficiency of Water Systems—A. T. Cook
Discussion—S. K. Knox—W. R. LaDue

### *Plant Management Div. — Thurs. P.M.*

Developing Meter Specifications—S. F. Newkirk, Jr.
Open Discussion
Developing Distribution System Records—W. V. Weir
Open Discussion
Service Line Materials—A Progress Report—W. A. Peirce
Discussion—Steven H. Taylor
Round Table
Application of Cathodic Protection to Water Towers and Tanks
Led by—W. W. Morehouse

## J. Arthur Carr Honored for 25 Years Service

J. A. Carr*

J. Arthur Carr, for 25 years superintendent of the Water Department of Ridgewood, N. J., was signally honored on the anniversary date of such service by associates, employees and a host of friends in the American Water Works Association.

On March 15th, at a Testimonial Dinner attended by 250 guests, Mr. Carr was presented with a framed testimonial—Mayor Frank D. Livermore of Ridgewood, making the presentation. From associates and employees in the Water Department he received a handsome desk-pen et, appropriately inscribed—the presentation being made by Edward T. White, Commissioner of Public Works.

On hand was Reeves J. Newsom, President of A.W.W.A., and other outstanding men in the profession, to praise the work of Arthur Carr. Remarked Mayor Livermore—"The large number and distinction of those gathered to honor Ridgewood's superintendent constitutes a far more eloquent tribute than anything I might be able to add." President Newsom commended former and present Commissioners of Ridgewood for the complete absence of political interference in the Water Department and the resultant efficiency and status which its 25 year manager had been able to attain.

Mr. Carr, a native of Utica, N. Y., held the position of superintendent of the Bergen Aqueduct Company, which owned the system when it was purchased by the Village of Ridgewood in 1921 for $450,000. It was a wise Commission that concluded that it had a "bargain" in the way of a manager at the time of the purchase.

*Mr. Carr is Chairman of the New Jersey Section of A.W.W.A.

## Bothered with Flies? Then Use Blue Paint

In a recent issue of "Technology Review" the reason why most hospital walls in France are painted a light blue color was revealed—the lighter shades of blue have been found to be by repellant. In Denmark, abattoirs and factories are painted blue for the same reason, and the same has been found true in certain tropical countries where screens have been littl used.

In an experiment reported, colored sheets of paper were employed. A close watch revealed that flies preferred (went to) colors in the following order: (1) green, (2) rose, (3) yellow, (4) azure blue, (5) red, (6) ultramarine. On the ultramarine blue only one fly was seen to alight, and the medium blues were shunned generally.

# SLUDGE FILTRATION

## *Sludge Conditioning**

*[The Second Article in a Series]*

By LeROY W. VAN KLEECK

Senior San. Engineer, Connecticut State Department of Health
HARTFORD, CONN.

*The Author*

IF sludge could be dewatered on vacuum filters without the use of conditioning chemicals, the filter operator would have a comparatively easy job. However, sludge conditioning with chemicals is *the* important step in sludge filtration and it is only when properly prepared sludge is delivered to filters that they perform successfully. Many factors affect conditioning.

Raw primary, raw activated, raw chemically-precipitated, semi-digested and digested sludges may be successfully filtered. Secondary settling tank sludge (humus sludge) may also be filtered with raw or digested sludges, preferably after digestion[1]. As a rule, raw primary, raw chemically-precipitated, semi-digested and digested sludges are conditioned with both ferric chloride and lime, sufficient to produce distinctly alkaline reaction. Occasionally ferric chloride is used alone but this invariably requires considerably more ferric chloride than would be needed if combined with lime. Since lime is by far the cheaper chemical, a combination of lime and ferric chloride generally proves the most economical. Raw activated and elutriated raw or digested sludges (usually the latter) are most economically conditioned with ferric chloride alone.

### *Elutriation of Sludge*

Elutriation, which might be popularly termed sludge washing, was conceived and developed by A. L. Genter who has lucidly described the process in this magazine[2]. It will not be repeated here. Briefly, the process involves sludge dilution, settling, decanting whereby amino acids in the sludge are washed out with relatively pure water. The process may involve batch fill and draw wash as continuous flow counter-current washing.

Elutriation eliminates the use of lime and diminishes the amount of ferric chloride required. This simplifies conditioning, prevents the ammonia and amine odor present when lime is used, and saves the cost of an addi ional chemical, its storage and handling.

Genter has listed other advantages for the process[2]. Against these advantages must be balanced the installation cost, operating costs, and the a carefully designed set-up, however, there is no reason why the sludge number of sewage treatment works receiving supposedly sanitary sewcannot be properly washed.

The sludge floc produced by ferric chloride alone is unstable and elutriated conditioned sludge should therefore be delivered promptly by continuous feed conditioning tanks to the filter vats. Batch mixing, where sludge is likely to be held, will prove unsatisfactory. Particular care should also be taken that the floc is not broken up before reaching the filter vats. In a summary of operating data to be listed in the fourth paper of this series, the results of sludge elutriation at Hartford, Conn., will be given.

### *Chemicals Used*

The purpose of chemicals for sludge conditioning is to gather the sludge solids into flocs which will release their bound-water and thereby prevent the blinding (clogging) of the filter cloth. The most common chemical used for conditioning is ferric chloride with or without lime. Alum and ferric sulphate, in particular, have been tried as substitues for ferric chloride but the results have been less satisfactory generally. The market price and conditioning advantages of ferric chloride places this chemical in its present favorable position. As new filter installations go into operation, however, it is sound practice to try different coagulants with the sludge and determine its filtrability by a Buchner funnel set-up. (The use of Buchner funnels will be described later in this series.)

### *Forms of Ferric Chloride*

Ferric chloride is being used for sludge conditioning at all the vacuum filter plants in operation in Connecticut and is proposed for those under construction. Some of these plants use the anhydrous (98%) ferric chloride, purchased in 150-lb. or 400-lb. non-returnable drums. Lump ferric chloride (60 to 62% ferric chloride) is used by other plants. The lump form is somewhat more troublesome to dissolve and more bulk must be handled for an equivalent amount of available ferric chloride. It has previously been shipped in barrels holding about 500 lbs., but at least one manufacturer now ships in sturdy 200-lb. and 300-lb. barrels. These barrels are said to reduce leakage to a minimum and to have some re-sale value. The more recent lump material is also in smaller particles which should hasten dissolving. Liquid ferric chloride has not been used in Connecticut primarily because plant railroad sidings are not available, and the cost of hauling and storing the liquid would exceed by too great a margin the present handling charges for the dry forms.

### *Feeding Ferric Chloride*

Ferric chloride is invariably prepared as a solution before mixing with the sludge. It is a good precaution to wear rubber gloves, if direct contact with the solution is necessary, as the chemical roughens the hands. Irritation to the eyes and throat, sometimes experienced when mixing the anhydrous form, can be avoided by use of a chlorine canister mask.

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*The first article in this series by Mr. Van Kleeck appeared in our March issue. It dealt with "Filter Design and Maintenance."

[1]Vacuum Filtration of Sludge from Secondary Settling Tanks, Keefer & Kratz, Sewage Works Journal, November 1935.

[2]A. L. Genter, "Sludge Filtration," Water Works & Sewerage, July, 1938.

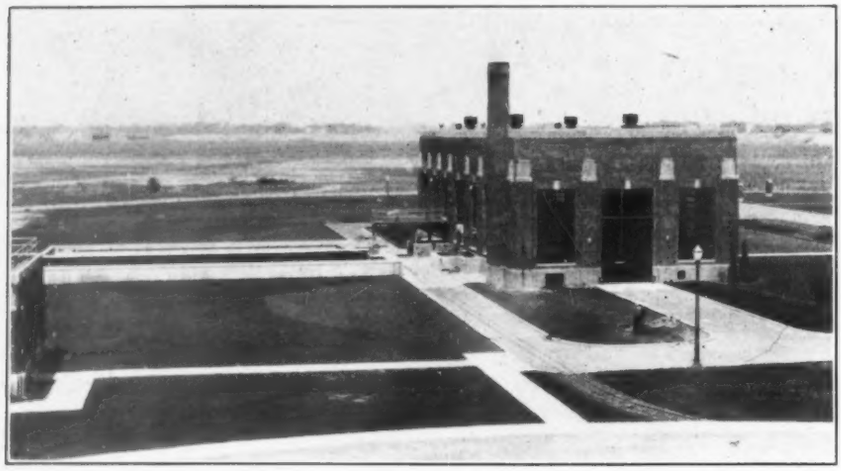


**Figure 1—Sludge Filtration Building, Hartford, Conn.**
*The small square concrete tanks adjoining the buildings are the elutriation sludge mixing tanks. The elutriation settling tanks (also utilized for sludge storage) extended from the back of the building. (Note industrial railway for carting cake.)*

Weak solutions, of say 10 or 15 per cent ferric chloride, are preferable to stronger solutions, of say 20 or 30 per cent, as more intimate and effective mixing is secured by the additional volume. Since weak solutions require more storage volume for the same percentage of available iron, a high percentage solution can be prepared and diluted with water in the feed line just prior to addition to the sludge. In the fifth and final paper of this series the writer will discuss proper materials for feeding ferric chloride.

There are several satisfactory types of ferric chloride mixing tanks in use. One common style consists of a square rubber-lined basin with a false-bottom wooden box suspended at the center for dissolving the chemical. From a near-by water connection the basin is filled with water and dissolving is accomplished usually by hand with paddles. Another type is a round tank lined with sodium silicate and containing air plates for dissolving and mixing*. At plants where only a limited amount of preparation is required, the chemical can be dissolved in discarded wooden or metal barrels. Such barrels will give but a few weeks service as rubber-lining or other special treatment is required to withstand strong ferric chloride solutions.

The solution is commonly fed to the sludge by mechanical feeders located between the chemical storage tanks and conditioning tanks. Adjustable displacement type feeders are recommended for this job rather than orifice feeders. The latter corrode and clog. Sometimes the amount of solution from these feeders is proportioned to the flow of sludge reaching the filter vats by weir settings, floats, or other means. Too much intermechanical control is undesirable, however, and independent settings for each conditioning chemical and sludge flow is preferable.

At batch-mix plants, ferric chloride is sometimes applied by dipping with a pail into barrels or vats of the prepared solution and distributing it through sludge in agitation. Sometimes the solution is introduced into batch-mix conditioning tanks by direct draw-down from the storage vat using a ruler or gage for measurement of the proper amount.

### *Forms of Lime*

Either hydrated or prestolite lime is generally used. Limes high in calcium oxide (CaO) and low in magnesium (Mg) should be purchased. If magnesium is present, magnesium hydroxide, which rapidly ruin filter cloths, will be precipitated. There are two types of readily available hydrated lime. Either is suitable for pH control in sludge digestion tanks but only the high calcium hydrate lime (No. 2) should be purchased for sludge conditioning. Typical analyses of such limes follows:

| | No. 1 High-Magnesium or Dolomitic Hydrate | No. 2 High Calcium Hydrate |
|---|---|---|
| Ignition loss | 20.00 % | 24.90 % |
| Silica | 1.36 % | 0.30 % |
| Iron-alumina | 0.64 % | 0.20 % |
| Calcium oxide | 46.00 % | 73.70 % |
| Magnesium oxide | 32.20 % | 0.70 % |

Spent "Prestolite," also known as "prest-o-lime," runs about 37 per cent available CaO, but as this percentage is rather variable, proper conditioning is sometimes an uncertainty. In addition more bulk must be handled and the material is rather messy to prepare. In its present status spent (hydrated) prestolite is none too favorable a conditioning chemical.

One vacuum filter plant under construction in Connecticut will be equipped with a lime slaker so that pulverized or pebble lime may be used, as materials less costly than hydrated lime.

When lime is added in the conditioning of sludge there is a pronounced ammonia and amine odor in the vicinity of the conditioning tanks and filters. This odor is largely the result of the ammonium hydroxide formed in the following reaction:

$$\underset{\text{(Bicarbonate of Ammonia)}}{NH_4HCO_3} + \underset{\text{(Hydrate of Lime)}}{Ca(OH)_2} = \underset{\text{(Calcium Carbonate)}}{CaCO_3} + \underset{\text{(Ammonium Hydroxide)}}{NH_4OH} + \underset{\text{Water}}{H_2O}$$

Ammonium bicarbonate is naturally present in sludge. The calcium carbonate produced is a contributing factor in the blinding of filter cloths.

### *Feeding Lime*

While dry lime can be added to the sludge for conditioning, better distribution results from preparing milk of lime. Electric paddle mixers are useful for this purpose. The reaction between sludge and lime appears to be slower than with ferric need for correct mechanical control it will be difficult to condition. With chloride, and milk of lime hastens the reactions which must occur for proper conditioning.

### *Mixing Period*

The best mixing period following the addition of chemicals to sludges varies slightly at every plant. Practice indicates however that short mixes are better than long, and that the tendency is to mix *too long*. A mixing period just sufficient to form a good floc should be used. If mixing is continued beyond this point the

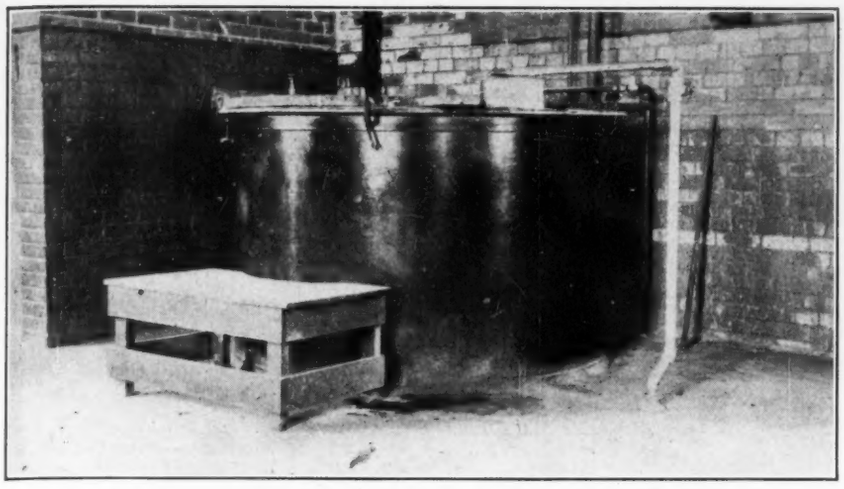


**Figure 2—Ferric Chloride Mixing Tank at New Britain, Conn.**
*Specially lined tank (final interior lining with sodium silicate) equipped with compressed air outlets for mixing. Solution feeds by gravity to a smaller rubber-lined tank which is followed by a displacement type feeder used for introducing the solution into the sludge conditioning tank.*

floc will partially disintegrate or become stringy.

In continuous-mix conditioning tanks, it should be possible to introduce the chemicals at different points in the tanks. In that way various detention periods may be secured. Generally 5 to 8 minutes should be an ample mixing time for the ferric chloride; in some set-ups 2 or 3 minutes is sufficient. The lime mix should not usually take over 5 to 10 minutes.

The sequence in which the chemicals are added should be considered when both lime and ferric chloride are used. In some cases the lime must be added last or the sludge is virtually unfiltrable. In other cases little difference can be noted and the ferric chloride and lime may be added practically together. Sometimes the conditioning set-up dictates the order of addition. For example, a Connecticut plant filtering digested sludge found that unless the lime was added first the vigorous mechanical agitation provided for the conditioning tanks broke up the floc produced by the ferric chloride and resulted in a poor filtering sludge. Laboratory work at this plant shows, however, an advantage in adding the lime last—but, only under ideal stirring conditions.

### *Amount of Chemicals*

Field experience has shown that there is (with most sludges) an optimum amount of ferric chloride to be used with or without lime. On either side of such optimum conditioning is adversely affected. Thus, an over-dose of chemicals may produce a poorly filtering sludge, as well as cause more damage to filter cloth than under-doses. Over-doses of lime used in conjunction with ferric chloride can usually be checked by employing pH tests on the filtrate. This will be discussed in the fourth paper of this series.

With many sludges the chemical requirements, if plotted, will show a sharp peak giving very definite dosages for optimum filtration (as shown by Buchner funnel tests); some other sludges have a flatter curve and the doses are not so critical. It is important for an operator to determine the type of curve for his sludge. Sludge is a complex conglomerate of widely varying characteristics and filtering results can be greatly improved if these properties are studied and known.

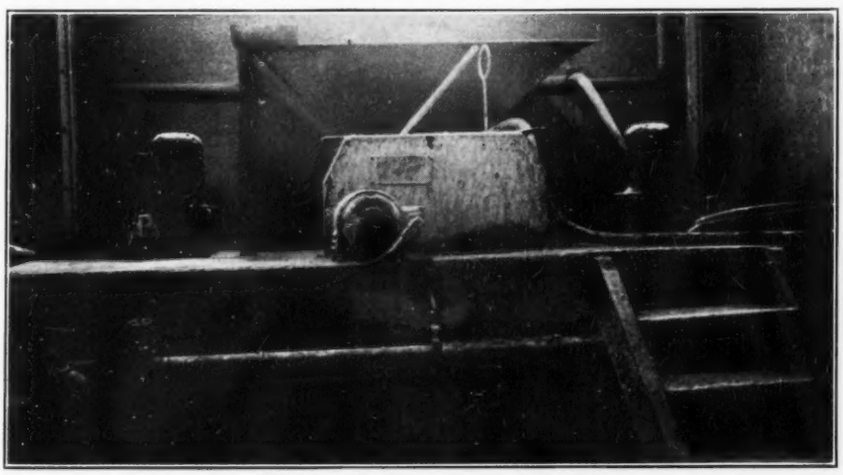


**Figure 3—Lime Mixing Tank at New Britain, Conn.**
*This tank is located in the basement. After mixing of the lime and water to produce a lime slurry, the mixture is pumped to a feeding tank equipped with a displacement type mechanical feeder which introduces the lime by gravity to the sludge conditioning tank.*

### *Computation of Amount of Chemicals Required*

The chemicals used for sludge conditioning may be compared at various filter plants, if the chemical doses are reported by per cent *on a dry basis*. So many pounds of chemical per 1000 gallons of wet sludge means very little if this sludge has 10 per cent solids one day and 15 per cent the next. As a guide to operators, and others not familiar with this method of computation, the following examples are given for determining the strength of ferric chloride solutions and the dry basis reporting of ferric chloride and lime quantities:

The ferric chloride should be reported as the pounds of anhydrous ferric chloride used per 100 pounds of dry solids filtered, i. e. per cent based on solids content, not volume. *The dry solids should include the sewage dry solids plus the dry ferric chloride added.*

Let us assume for an example that a plant is buying lump ferric chloride. This chemical contains approximately 60 per cent available dry ferric chloride. The remaining 40 per cent is water of crystallization. Suppose 20 pounds of the commercial material, as weighed, is used to filter 500 gallons of digested sludge containing 10 per cent sludge solids. The specific gravity of the sludge is found to be 1.03. (This can be determined by weighing a unit volume and comparing its weight with the weight of an equal volume and comparing its weight with the weight of an equal volume of water. Thus, $\frac{\text{Wt. of sludge*}}{\text{Wt. of water*}}$ =specific gravity.)

Then, 500 x 8.33 (wt. of gal. of water in lbs.) x 1.03 = 4289.95, say 4290 lbs. (total wt. of wet sludge)

*Do not include the weight of the container in these weights.

Since, 10% of this weight is dry solids, 4290 x 0.10=429 lbs. *dry sewage solids.*

Now, 20 lbs. of commercial chemical x 0.60 = 12 lbs. of dry ferric chloride ($FeCl_3$).

Then, 429 + 12 = 441 lbs. (*total dry solids*)

Since,

$$\frac{\text{Lbs. dry } FeCl_3}{\text{Lbs. dry sewage solids} + \text{lbs. dry } FeCl_3} \times 100 = \%\ FeCl_3 \text{ dry basis.}$$

Then, $\frac{12}{441} \times 100 = 2.7\%$ $FeCl_3$ used on a dry basis.

In passing it should be pointed out that not all of the total dry solids computed above are in the sludge cake, some being in the filtrate. The quantity of solids in the filtrate is a small percentage of the total, but can be computed if a total solids determination is made on the filtrate, and if the total lbs. of filtrate discharged by the filter during the run are known. By eliminating the specific gravity calculation for the wet sludge the solids loss in the filtrate will generally be about balanced, and the result will be more nearly the dry solids removed in the filter cake. Several calculations seem to confirm this if the filter cloths are in good condition.

If the wet sludge cake weight is known and ferric chloride only, or some other *one* chemical is used as a conditioner, the per cent moisture of the cake and the total dry solids in the cake, which include the weight of the chemical, can thus be determined. The pounds of dry ferric chloride used divided by the pounds of solids in the cake, and multiplied by 100, gives the per cent of ferric chloride on a dry basis.

## *Computation and Strength of Ferric Chloride Solutions*

(A) Frequently the lbs. of dry ferric chloride used must be determined from a previously prepared solution. The strength by weight of fresh ferric chloride solutions is computed as follows:

Suppose, 500 lbs. of 60% commercial ferric chloride has been added to 500 gallons of water, then,

500 (gals. of water) x 8.33 = 4165 lbs. of water.

500 (lbs. of commercial lump ferric chloride) x 0.60 = 300 lbs. dry ferric chloride.

4165+500=4665 total lbs. water and commercial chemical.

$$\frac{300}{4665} = 0.064 \text{ or } 0.064 \times 100 = 6.4\%$$

solution of ferric chloride.

Knowing the strength and the number of gallons of solution used, the lbs. of dry ferric chloride is readily computed. Thus, for example, suppose 20 gallons of a 20% solution of ferric chloride (strength of which has been determined as above) is used for filtering a certain quantity of sludge. Then,

20 (gals. of solution) x 8.33 (wt. of gal. of water in lbs.) x 1.154 (specific gravity of a 20% solution at 17.5°C.)*x0.20 (per cent strength of solution) = 38.5 lbs. of dry ferric chloride used.

[*This figure was taken from the "Handbook of Chemistry and Physics," The Chemical Rubber Co., Cleveland, Ohio, Pp. 1100.]

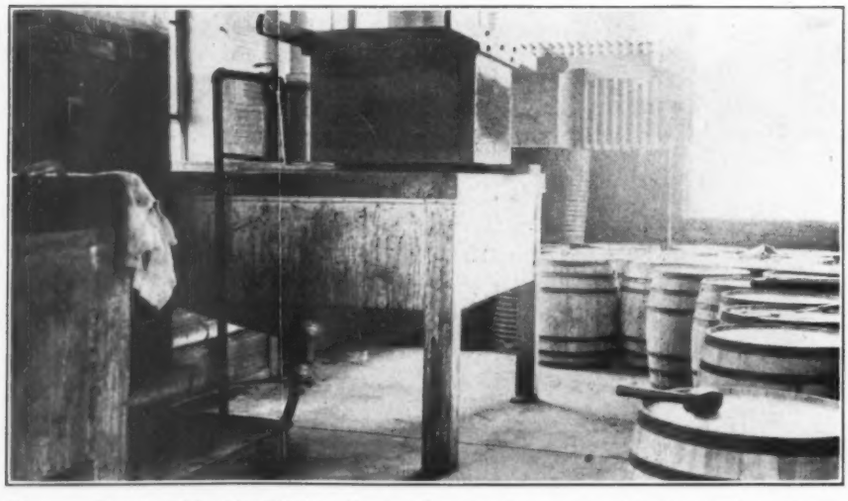


**Fig. 4.—Ferric Chloride Mixing Tank (Two Units are Provided) at West Haven** *The lump or anhydrous salt is dissolved in the wooden box shown on top of the tank. The box is then removed and the tank filled with water to a level to give the desired strength of solution. The ferric chloride is fed by gravity through rubber hose to batch-mix sludge conditioning tank located on the floor below.*

The specific gravity of course varies with the strength of solution. It can be obtained from handbooks, determined by weight as explained in the previous section, or by the use of a hydrometer. Determination by unit weight is recommended.

(B) It is assumed that the commercial chemical contains a definite amount of available ferric chloride. This is not always true. Furthermore ferric chloride solutions tend to stratify and when drawing the solution from the bottom of the storage tank there is a tendency for the strongest solution to be drawn off first and a weaker solution drawn as the vat is emptied. This is caused not only by natural stratification but from a tendency for absorption of moisture from the air as the solution stands and the diluted mixture is drawn off last.

The titration method given below is useful for checking ferric chloride solutions. Samples for testing must be collected with great care. They may be taken directly from the solution feed line, or by compositing a sample from portions taken at various depths in the storage tanks.

The titration method gives greater accuracy and is easily performed. The procedure follows:

Take 2 cc. of the prepared $FeCl_3$ solution from the storage tank. Dilute with about 50 cc. of water and add 2 cc. of pure hydrochloric acid (HCl). Add 10 cc. of 30% potassium iodide (KI) solution and mix thoroughly. The mixture can be left in the dark for about 10 minutes, although omission of this refinement is generally permissible.

Titrate with N/10 sodium thiosulphate ($Na_2S_2O_3$) solution, using starch solution as an end point indicator. About one (1) cc. of starch solution is added when the mixture is pale yellow. If fading should be held in the dark as sug- $FeCl_3$ per cc. of ferric chloride solution. The percent ferric chloride in the solution will then equal the grams of $FeCl_3$ per cc. of solution, times 100 and divided by the specific gravity of the $FeCl_3$ solution.

For example, suppose 13 cc. of N/10 sodium thiosulphate solution are used in the titration above and the specific gravity of the solution of $FeCl_3$ has been found to be 1.07 by the unit volume weight method previously described. Then,

$$\frac{13 \times 0.0081 \times 100}{1.07} = 9.8\% \text{ ferric}$$

chloride solution.

This titration method is very easy to perform. Operators possessing limited laboratory facilities or who are not familiar with the preparation of solutions of known strength can use about 3 grams of the KI crystals in place of the solution. The one-tenth normal (N/10) sodium thiosulphate may be purchased ready for use from laboratory supply houses. If kept in the dark the solution will be suitable for use for from 3 to 6 months, beyond which time it is likely to lose strength.

### *Computation of Lime Used*

The lime used in sludge filtration is reported as pounds of available CaO used per 100 pounds of dry solids, i. e. per cent CaO of dry solids. *The weight of dry solids includes the weight of the dry sewage solids and the weight of commercial lime,* (the lime is assumed to be free of moisture).

Suppose 10 50-lb. bags of lime containing 72% available CaO (look on the bag for the CaO content) are used for conditioning 3000 gallons of 10% solids sludge.

Then, 3000 x 8.33 x 0.10=2499, say 2500 lbs. of dry sewage solids. (Specific gravity of sludge has been omitted. See discussion under "Computation of Ferric Chloride Used from Wet Sludge Filtered.)

10 bags at 50 lbs. per bag = 500 lbs.

2500 + 500 = 3000 lbs. *total dry solids.*

500 x 0.72 = 360 lbs. of available CaO.

$\frac{360 \times 100}{3000}$ = 12% CaO. (dry basis). *Ans.*

(The next paper by Mr. Van Kleeck will discuss some of the other factors affecting sludge conditioning, together with the computations of filter yields and the disposal of filter cake.—*Ed.*)

## "Silica in Water"

Silicia in water is the subject of a 46 page pamphlet by M. C. Schwartz, Louisiana State University, University, La. Following a brief section on the colorimetric determination of silica, the bulletin is devoted to a comprehensive bibliography with abstracts arranged chronologically, and with an author index. Copies are available to those interested, on application to the university. The price of the bulletin is fifty cents.

## Tyler, Texas Voted Best Water Supply Rating for Second Year

In Texas the State Department of Health issues a certificate of merit each year to that city considered to have the best overall water supply in the state. A schedule of ratings is employed in evaluating the status of Texas' public water supplies.

The City of Tyler, and Superintendent Jack M. Lloyd, have reason to be proud of the fact that the State's Award for 1st place has for two years in succesion been voted award was made during the An- Tyler's water supply system. The nual Water Works Convention and Short School at Texas A. & M. College.

The rating of 99% attained by the Tyler system for 1937, and again for 1938, is based on sources of supply, sanitary conditions, care and effectiveness of treatment, quality of finished water, status of distribution system and its maintenance.

The supply of Tyler comes from a lake, supplemented by an auxiliary supply from deep wells. Treatment involves egective algae control, super-chlorination and filtration and chlor-amination, which maintains essentially sterile water through the distribution system, controlled by hourly sampling and checking by the laboratory.

Credit for the improvements which raised Tyler's rating of 76% in 1935 to 99% by 1937 can be taken by Jack M. Lloyd who became superintendent of Tyler's system in 1935.

(We were most pleased to find such an acknowledgement in a complimentary press item given a conspicuous spot in one of Tyler's newspapers. This gives us another opportunity to say again: The more of this sort of publicity, the better.—Ed.)

## ALBERT BRENSLEY NOW CONSULTING SANITARY ENGINEER

Albert A. Brensley, until recently engineer and superintendent for the Department of Sewerage and Sewage Treatment of Kankakee, Ill., resigned on April 1st to establish his own office in Kankakee as Consulting Sanitary Engineer.

Mr. Brensley will specialize in reports, design and operation of sewer systems, treatment works and pumping stations. With his background of design and operating experience, his principle aim is to establish an advisory practice in sewerage and sewage treatment, particularly in assisting City Engineers and others faced with sewerage betterments and operating problems.

## CHLORINE INSTITUTE HOLDS ANNUAL MEETING

The Chlorine Institute, Inc., held its Annual Meeting on March 10, 1939 at The Chemists' Club, New York, N. Y. The following directors were re-elected:

N. E. Bartlett, Pennsylvania Salt Mfg. Co.
Thomas Coyle, E. I. duPont de-Nemours & Co.
John A. Kienle, The Mathieson Alkali Works.
Louis Neuberg, Westvaco Chlorine Products Corp.
Eli Winkler, Columbia Alkali Corp.
H. M. Hooker, Hooker Electrochemical Co.
S. W. Jacobs, Electro Bleaching Gas Co.
E. C. Speiden, Innis, Speiden & Co.

At a directors' meeting following the Annual Meeting, the officers shown below were elected for the year 1938:

S. W. Jacobs, President
E. C. Speiden, Vice President
Robert T. Baldwin, Sec'y.& Treas.

Activities of the Chlorine Institute of principal interest to readers of this magazine are those directed to improving and advancing the application of chlorine and chlorine products in the sanitation field; improving chlorine containers and advancing safety in respect to packaging, storage, transportation, handling and use of liquid chlorine.

One meritorious accomplishment of the Institute has been the development of standard valves for chlorine cylinders, ton-containers and tank cars. Such valves have replaced earlier valves of almost as many designs as there were chlorine manufacturers. At present the Institute is making a critical study of fusible safety plugs for cylinders and ton-containers, with the aim of improving the quality and dependability of these essential safety devices which have at times given trouble due to porosity or defective bonding of the fusible metal core.

# MAIN BREAK DETECTORS

## *A Scheme for Prompt Detection and Location of Breaks on Arterial Mains*

By ALFRED F. THEARD*
Gen'l Supt., Sewerage and Water Board, New Orleans

THE grounds of the main waterworks plant of New Orleans occupy an area of 74 acres. The plant is connected to the Mississippi River by two large water intake pipes having a diameter of 48 inches. Through these pipes, the raw river water is pumped to the reservoir system of the Purification Plant. This pumping is performed by three steam engine driven low lift pumps having a total capacity of 120 million gallons per day. In addition there are three electrically driven pumps (the combined capacity of any two of which is equal to 150 million gallons per day) installed in the Low Lift River Pumping Station, an adjunct of the water works plant, located near the river end of the intake.

When the raw water reaches the purification plant, it is settled, treated, filtered and chlorinated and then pumped directly into the distribution system.

The distribution system of New Orleans is of the usual cross network type, comprising bell and spigot cast iron pipe with lead-caulked joints. In recently constructed lines "Hydrotite" has been used in place of lead for jointing.

There is only one pumping plant for the entire system. This is located at the upper limits of the city. An auxiliary pumping plant is in course of erection. We have no elevated tanks or stand pipes.

The City of New Orleans is supplied with water by six pumps; four plunger pumps with a rated capacity of twenty million gallons per day each, and two centrifugal pumps. The rated capacity of the centrifugal is roughly twice that of the plunger.

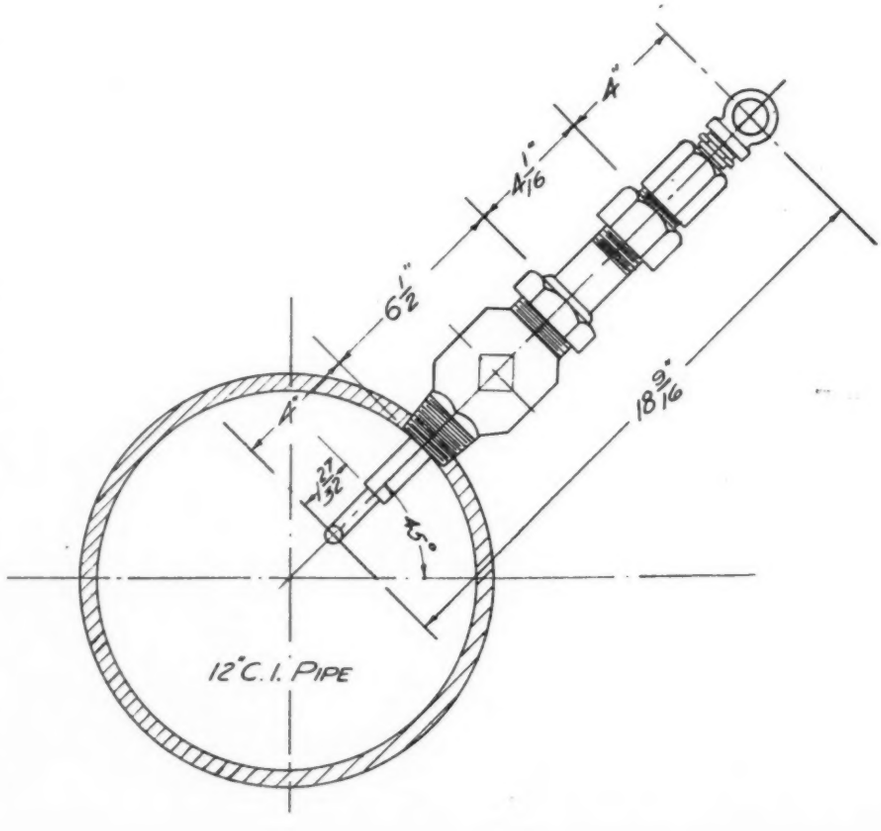
These pumps discharge into four mains known as the feeder arteries of the system; 48 in., 43 in., 36 in. and 30 in. All of these arterial mains extend to the business and residential sections and are arranged to cross-feed into one another in case of an emergency or break on any one. During normal operations these tie-in connections are valved off, so that each arterial feeder functions as an independent line straight through.

Some years back a break in one of the arteries presented a most difficult problem. Much time was lost in first determining the artery that was broken, and in combing the city in order to cut off the valves necessary to isolate that line. To remedy this, since each main connects into the system at a distance of several miles from the plant, check valves were installed at the grid end of each line, thereby preventing the other mains from feeding back through the ruptured line to the break, after the water entering it had been cut off at the pumping station.

### *A Scheme for Prompt Break Location Devised*

In order to determine promptly which artery is broken, it was decided to install a pitot tube in each of the four lines. The design of the tube is clearly shown in the accompanying diagram. It is to be noted that the static and impact orifices are 180 deg. apart, thereby giving maximum differential in pressures. The corporation cock allows for removing the tube for inspection and cleaning if necessary.

Since the tube was to be placed in a single position within the pipe it




*Sketch Showing Position of Pitot-Tube in the Main—Also Dimensions*

*The author of this article passed on shortly after its writing. This contribution, from a capable engineer and admired gentleman, is thought to represent his last writing for publication. It is printed posthumously in memory of a contributor greatly admired.—Ed.

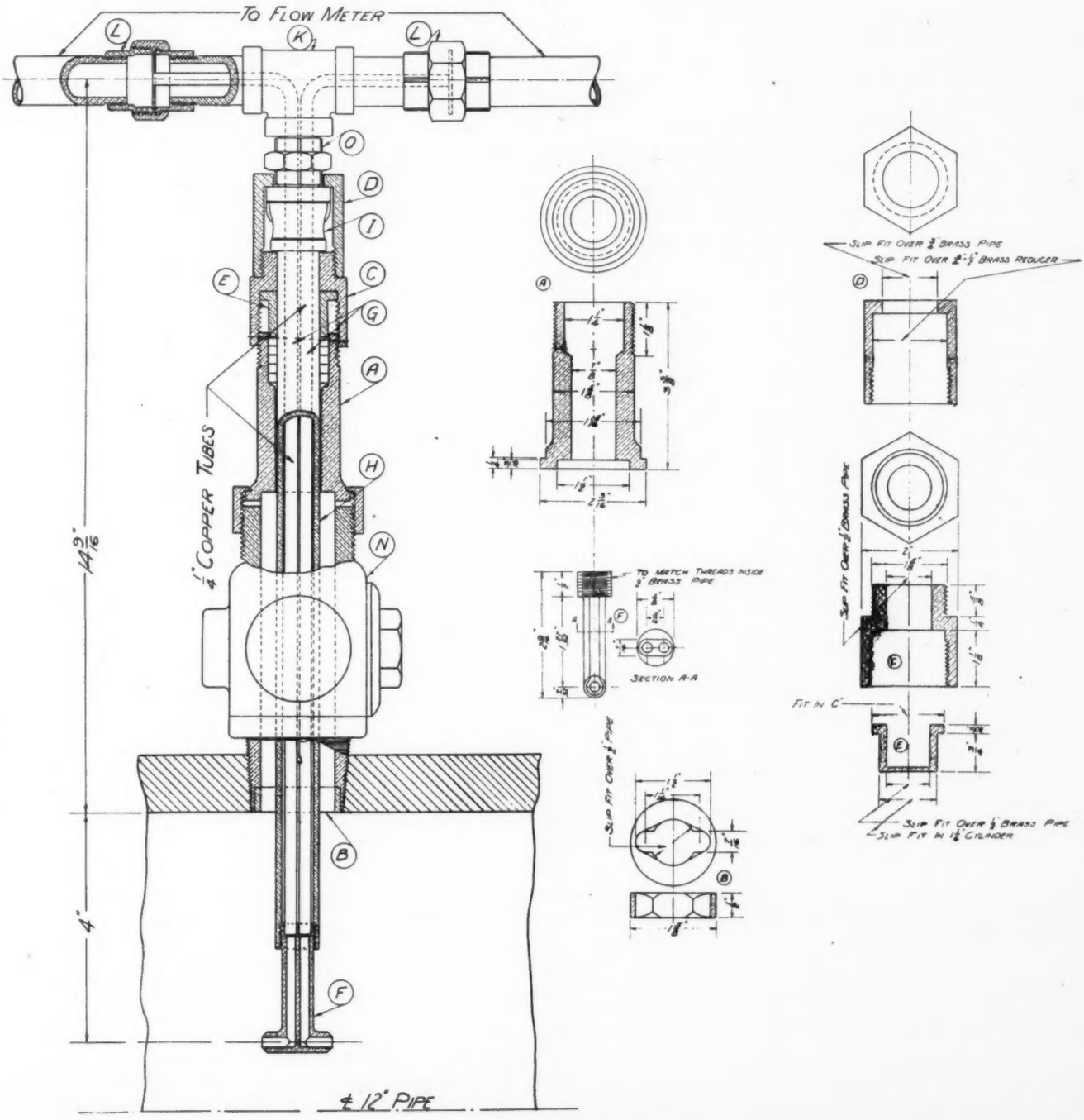
was necessary to determine the pressure differentials indicated by the tube, when known quantities of water were passing through the pipe. This was done by placing the tube end near the center of the pipe and allowing the discharge from two pumps to pass through the main in question.

Having a pressure differential corresponding to a known quantity, we were then able to calculate the quantity that corresponded to a velocity head (differential) of 12 inches of mercury as indicated by the pitot-tubes. This quantity represented the full scale reading on indicator charts of a flow-meter when the instrument was connected to the ends of the pitot orifice tubes, with pipes laid on a constant up-grade to the flow meter inside the pump station. This precaution was taken to avoid trapping of air within the lead-in tubes and thereby introducing considerable error.

Similar tests, or calibrations, were performed for each main artery, and the four instruments stand side-by-side in the pump house. The total 24-hour rate of flow is obtained by a summation of the readings of the four charts.

### *Telltale Readings*

A rapid increase in the readings of any single instrument followed by a sudden dropping off of the other, signifies a break in that particular line. Upon this discovery, the hydraulic valve on the ruptured main is immediately closed. When, as before mentioned, the check valve at the far




***Detail Drawing of Pitot-Tube***

end of the artery main prevents back flow from the distribution mains through the break. In this manner the break is discovered, located, and rapidly repaired with little, if any, inconvenience to consumers.

This greatly reduces the time that the pressure on the distribution system is deficient as the result of a feeder artery failure. Most important, the scheme has been of considerable help in indicating *at once* which main is broken, and reduces water loss, damage, consumer inconvenience, and time formerly lost in hunting for the location of the break.

### *Construction of the Pitot-Tube*

In the accompanying drawing the design of the pitot-tube is shown in detail. The letters in the accompanying "List of Materials" designate the parts so lettered in the drawing.

LIST OF MATERIALS

| ITEM | NO. | DESCRIPTION |
|---|---|---|
| A | 1 | BRASS, $2\frac{1}{4}$" DIA. OR HEXIGON $3\frac{3}{8}$" LONG |
| B | 1 | " $1\frac{3}{4}$" " $\frac{1}{2}$" " |
| C | 1 | " 2" " 2" " |
| D | 1 | " $1\frac{7}{8}$" " 2" " |
| E | 1 | " $1\frac{1}{2}$" " 1" " |
| F | 1 | " $1\frac{1}{2}$" " $2\frac{5}{8}$" " |
| G | 1 | COPPER TUBING $\frac{1}{4}$" O.D. 4'-0" " |
| H | 1 | BRASS PIPE $\frac{1}{2}$" I.P.S. 1'-2" " |
| I | 1 | " REDUCER $\frac{3}{4}$" × $\frac{1}{2}$" |
| J | 7 | " $\frac{3}{4}$" SHAFT NIPPLES 2" " |
| K | 1 | " $\frac{3}{4}$" TEE |
| L | 6 | " $\frac{3}{4}$" UNIONS - JEFFERSON |
| M | 2 | " $\frac{3}{4}$" ROUGH STOP COCKS - T-HEAD |
| N | 1 | " $1\frac{1}{2}$" CORPORATION COCK |
| O | 1 | " $\frac{3}{4}$" UNION - JEFFERSON |

*List of Materials for Pitot-Tube Construction*

# THE CENTRIFUGAL MACHINES AT NIAGARA FALLS

(A Statement of Fact)

**By STUART OTTO, President**
**American Centrifugal Corp.**
**NEW YORK, N. Y.**

THERE has been a lot of talk about the fact that the centrifugal dewatering machines have been removed from the screening plant at Niagara Falls, N. Y. As to the reason, many rumors have been discussed by engineers everywhere. Most of them are without foundation, because only a very few have learned the real reasons for their removal.

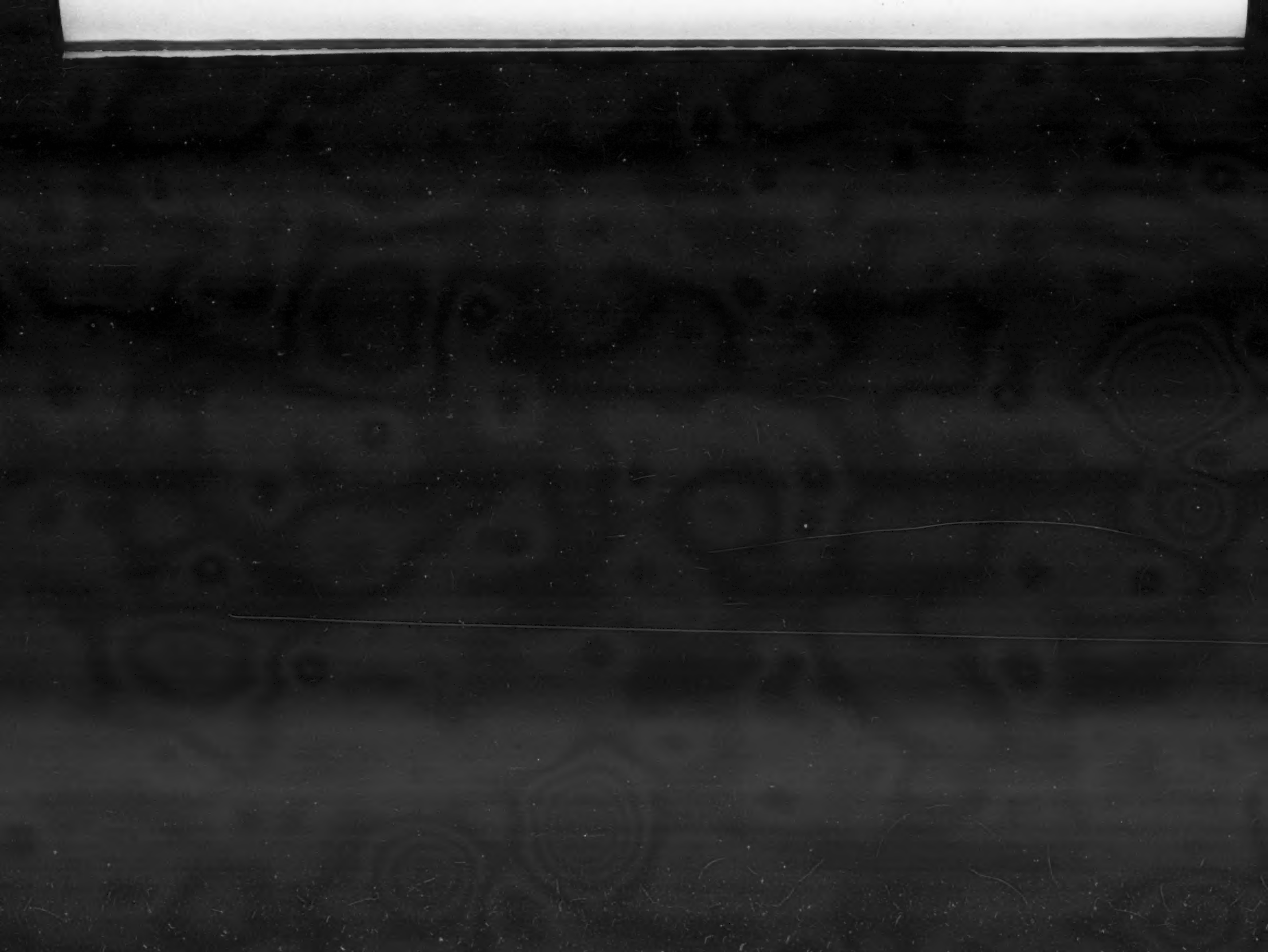
### *The Facts in the Case*

The truth of the matter is that the design of the plant's equipment, as installed, was not at all suitable for the satisfactory handling of the screenings up to the point where they were fed to the dewatering centrifuges. A fine coal was used as a filtering medium on the screens. Coke breeze has recently supplanted the use of the unsatisfactory fine coal. Coke breeze, being of a lighter specific gravity than coal, is not an unsatisfactory material to centrifuge; whereas, coal of the type used was so. This was particularly true under conditions that existed at Niagara Falls which made it impossible to feed a uniform mixture to the centrifuges. Coal being much heavier than screenings, settled in the storage hoppers. This created a most irregular supply to the centrifugals of a quantity of wet coal without screenings, followed by an admixture of coal and screenings, ranging in proportion from 15% coal to 85% screenings in four times the amount of water, to a supply of 80% coal and 20% screenings mixed in ten times the amount of water. Analyses showed no two tests near enough alike to permit feeding to the centrifugals uniformly. Naturally such feedings caused unbalance in the basket, creating undue vibration.

The manufacturers of the centrifuges offered at their own expense to make certain improvements in the auxiliary equipment (which was not supplied by them), providing that the production guarantees were reduced, but that could not be arranged. The specific gravity of the coal and the inadequate storage and feeding equipment made it impractical to feed, under the then existing conditions, at a high enough rate to attain the guaranteed centrifuge production. Now that coke is being used instead of coal, it would be quite reasonable to produce the required capacity and thus meet all the guarantees; however, provided that the corrections first be made in the auxilary equipment. Production records of centrifuged solids (without the admixture of coal) at other plants by the same machines are definite proof that the guarantees at Niagara Falls could have been met under circumstances such as they should have been.

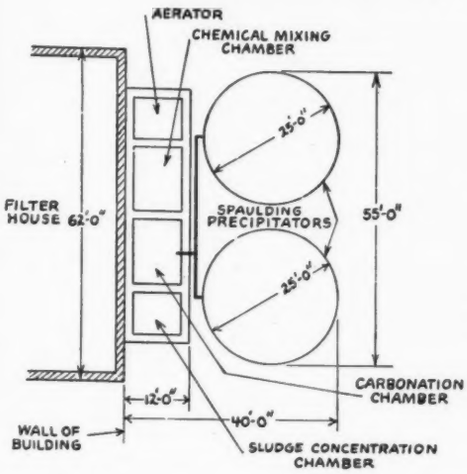
The American Centrifugal Corporation cordially invites anyone interested to visit the Demonstrating Plant at Elizabeth, N. J., where there are two full size American Centrifugal Machines operating. The plant is equipped so that various types of sludges can be delivered to it by motor truck, or otherwise, for testing purposes. Those interested are also invited to visit the installation of the City of Ne wYork, at the Jamaica, L. I. Screening Plant, which is identical to the machines which were installed at Niagara Falls. The Jamaica Plant has been running daily for more than a year and a half.

(Mr. Otto, feeling that the statement of bare facts as they appeared in the annual review "Progress in Sewerage and Sewage Treatment"—in our February issue, concerning the removal of the Niagara Falls centrifuges, would prove hurtful to the reputation of the American Centrifuge, has accepted our invitation to clarify developments in the Niagara Falls situation in the above statement. Ed.)

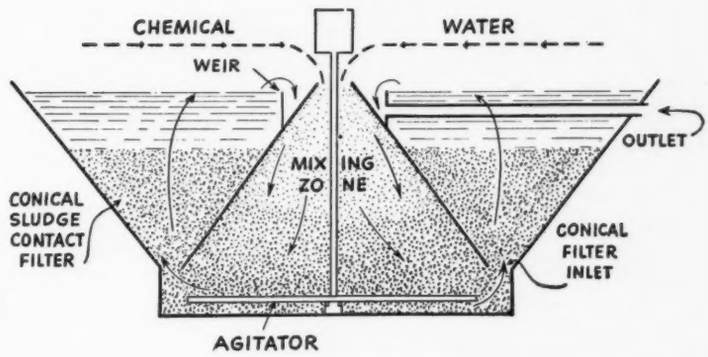


# A MORE STABLE WATER AT A LOWER COST

## Permutit's Spaulding Precipitator Revolutionizes Municipal Water Treatment!




**PLAN VIEW** — Note how compact this typical Spaulding Precipitator layout is! The Precipitator area is only 1540 sq. ft., less than half the 3399 sq. ft. of clarifier area needed for an equivalent cold lime plant of the conventional type.




**CROSS-SECTION VIEW**—The Spaulding Precipitator is completely new in principle. It consists of two compartments, (a) Mixing Zone (b) Conical Upflow Sludge Contact Filter. No settling of sludge takes place—an exclusive feature.

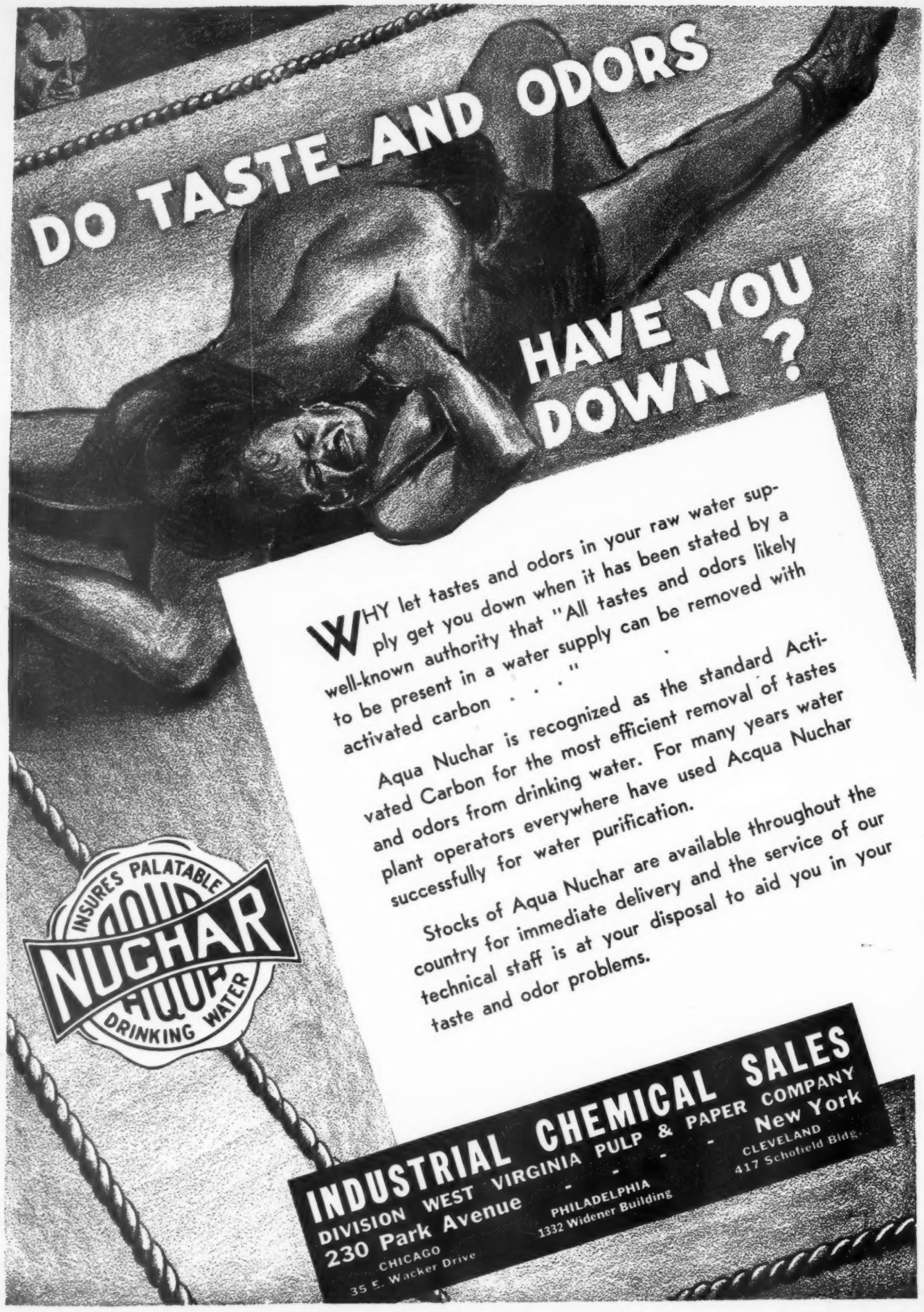
## Why you get clearer effluent with Spaulding Precipitator

In ordinary settling basins, sludge settles from water before full reaction takes place. In the Spaulding Precipitator, however, sludge is kept continuously suspended.

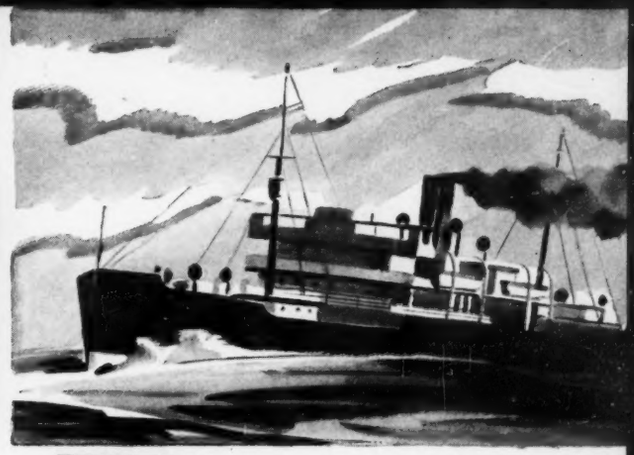
This feature speeds up precipitation, keeps sludge fresh. Softening is accomplished without putrefaction —water is so stable that recarbonation is often unnecessary.

In addition, the suspended sludge acts as a contact filter to make a clearer effluent than is possible with ordinary cold lime treatment. The conical cross-section of the outer compartment keeps the sludge at uniform density. There is a sharp division between the sludge filter and the clear effluent.

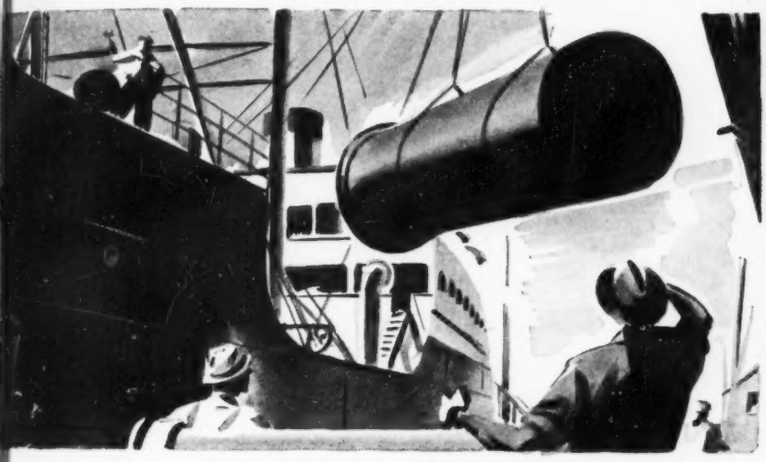
These features not only give you a clearer effluent in a shorter time, but save real money on chemical costs, too. Write for illustrated booklet that describes the Spaulding Precipitator in detail. It's free. Address The Permutit Company, Dept. G1, 330 West 42nd Street, New York.


DO TASTE AND ODORS
HAVE YOU
DOWN ?
WHY let tastes and odors in your raw water supply get you down when it has been stated by a well-known authority that "All tastes and odors likely to be present in a water supply can be removed with activated carbon . . . "
Aqua Nuchar is recognized as the standard Activated Carbon for the most efficient removal of tastes and odors from drinking water. For many years water plant operators everywhere have used Acqua Nuchar successfully for water purification.
Stocks of Aqua Nuchar are available throughout the country for immediate delivery and the service of our technical staff is at your disposal to aid you in your taste and odor problems.
INSURES PALATABLE
NUCHAR
DRINKING WATER
INDUSTRIAL CHEMICAL SALES
DIVISION WEST VIRGINIA PULP & PAPER COMPANY
230 Park Avenue - - - New York
CHICAGO
35 E. Wacker Drive
PHILADELPHIA
1332 Widener Building
CLEVELAND
417 Schofield Bldg.

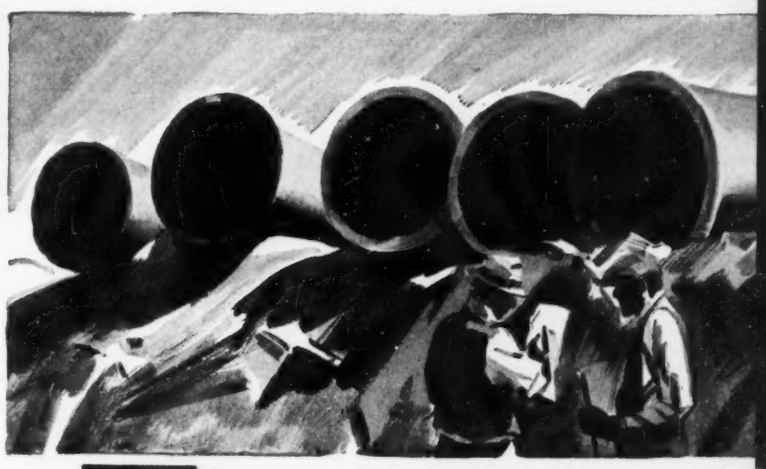
Our story begins with the installation of a 48-inch cast iron water main under North Broad Street, Philadelphia, in 1901. After 24 years of service, the construction of the Broad Street Subway required its removal. The pipe was salvaged, reconditioned and placed on sale for service not requiring A.W.W.A. wall thickness.



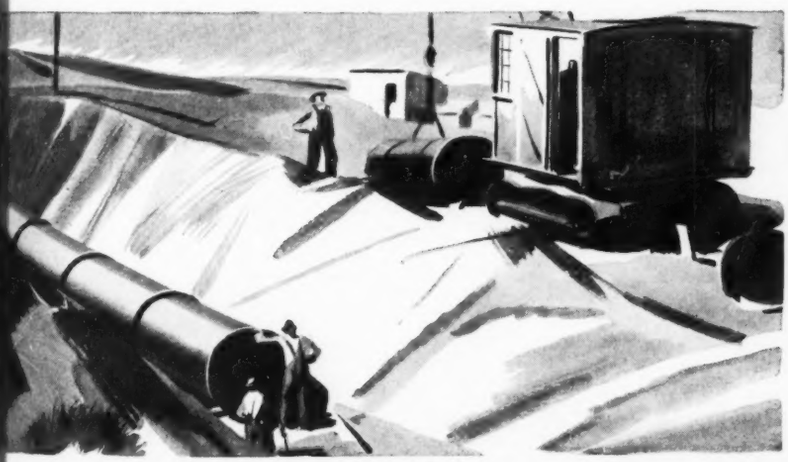
Now our pipe is en route from Philadelphia to Los Angeles, 4866 nautical miles away, bought for the City of Glendale, California, to be used for an intercepting sewer river crossing under the Los Angeles River.



**Here you see it** being unloaded at Los Angeles for delivery to the job at Glendale, where it was laid for the *second time*. Sold at a saving over the cost of new pipe yet having realized a good salvage value for Philadelphia, both cities benefitted.



Thirteen years later a Flood Control program required deepening the Los Angeles River channel, involving relocation of the Glendale intercepting sewer. It was found economical to uncover this 48-inch cast iron line and remove it for reinstallation.

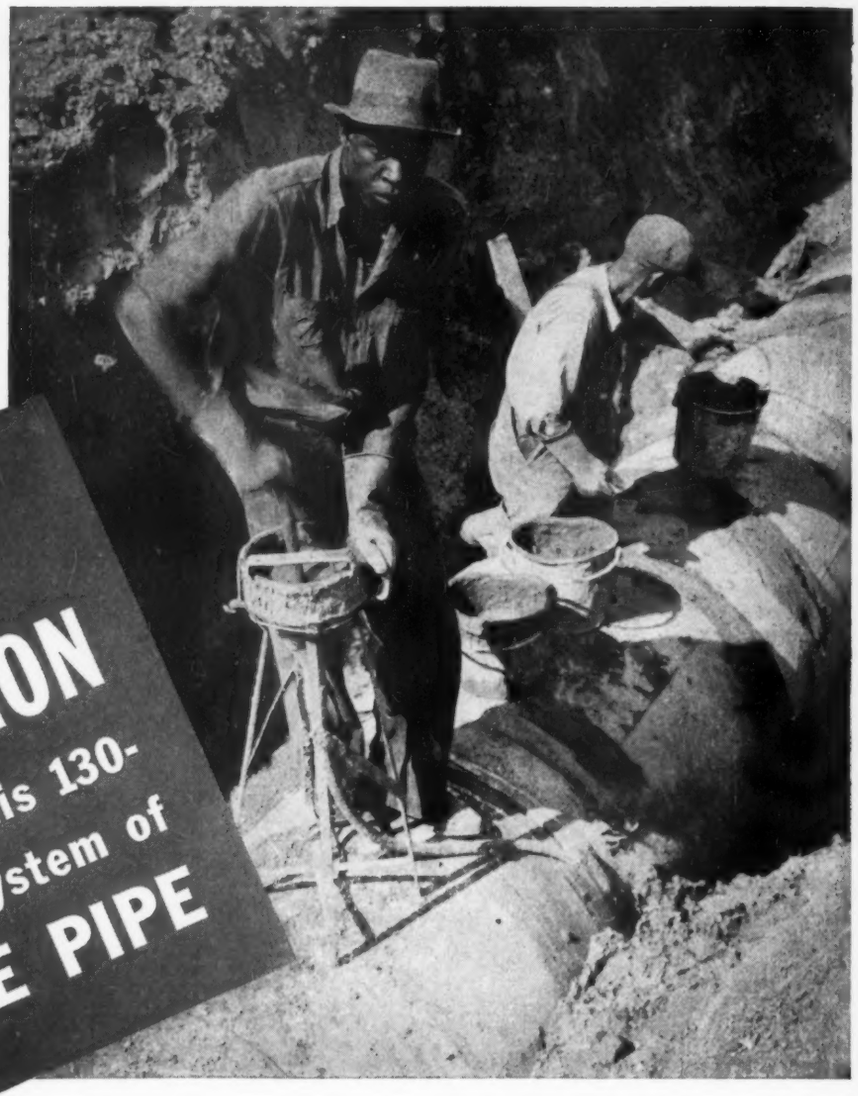


**Here our pipe** is starting out on its *third life*, after 24 years of service at Philadelphia and 13 years of service in its first location at Glendale. Barring unforeseen circumstances, this cast iron pipe line will serve for a century or more in its present location.

**THIS STORY of the adventures of a 48-inch pipe line is a striking example of the salvage value of cast iron pipe. The recognized standard material for underground mains, cast iron pipe is also unequalled for long life and low maintenance cost, justifying its reputation as Public Tax Saver No. 1**

CAST Q IRON

Look for the "Q-Check" Registered trade mark. Cast iron pipe is made in diameters from 1¼ to 84 inches.



Making the cement mortar joints on a 36-in. reinforced concrete pipe sanitary interceptor, Arlington County, Virginia. Work conducted under Roy S. Braden, county manager; Chester, Laboon, Campbell, Davis & Bankson of Pittsburgh, consulting engineers.

# LOW INFILTRATION

## ...a feature of this 130-mile sewerage system of CONCRETE PIPE

ARLINGTON COUNTY, VIRGINIA, just across the Potomac from Washington, secured a PWA loan and grant to build a $2,500,000 sewerage system. Included in the project were over 100 miles of concrete pipe lateral sewers and 30 miles of concrete pipe interceptors ranging in diameter from 10 in. to 42 in.

Typical sections of pipe lines, including manholes, were given rigid infiltration tests before the system was paid for. As a result of using concrete pipe, with proper foundations in yielding soils, and with carefully made portland cement mortar joints . . . infiltration tested as low as 600 and up to 6,000 gallons, averaging only 2,500 gallons per mile per day. This is considered very low for the conditions.

Whether your sewers are a few inches or many feet in diameter, remember that concrete pipe minimizes infiltration and leakage . . . is strong and durable . . . resists corrosion . . . is moderate in first cost . . . and serves with little maintenance.

**PORTLAND CEMENT ASSOCIATION**

**33 West Grand Avenue • Chicago, Ill.**

*A National Organization to Improve and Extend the Uses of Concrete*

# ALBEMARLE'S NEW COMBINATION WASTES DISPOSAL PLANT

## *Exemplifies Effective Adaptation of Architectural Concrete; Handles Textile Wastes*

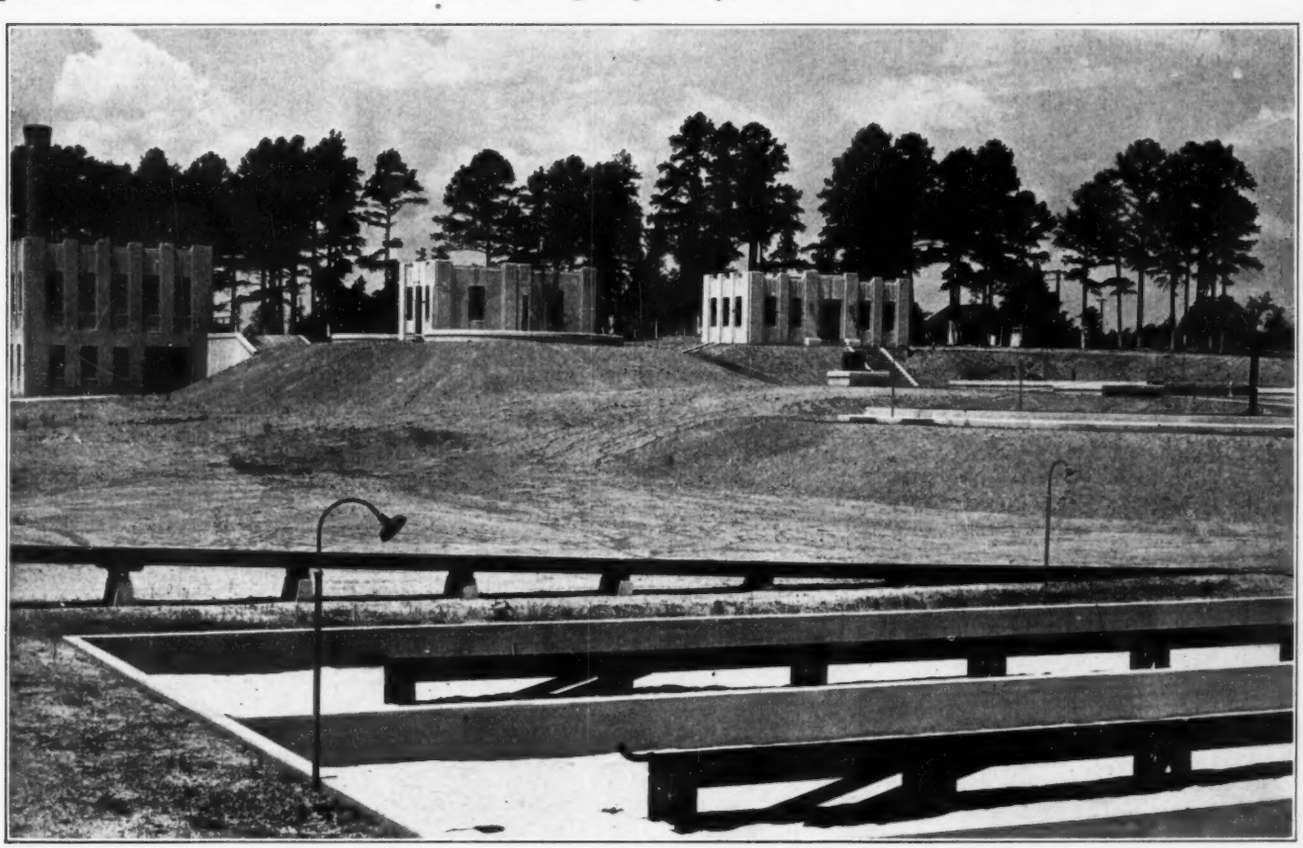
By GEORGE S. MOORE
Supt. Public Utilities
ALBEMARLE, NORTH CAROLINA

*The Author*

PROVING that even such prosaic things as sewage treatment plants and refuse incinerators can combine beauty with utility, at low maintenance cost, the City of Albemarle, N. C. has employed architectural concrete in its combination refuse incineration and sewage treatment plant. We believe the pictures of the plant will satisfy the reader tractive a plant as any small comthat the result is as neat and atmunity can boast.

Towns below Albemarle on Long Creek, into which sewage had been discharged untreated, had complained of pollution. The farmers along the stream had also registered their complaints along with the State Health Department. That Long Creek was polluted there seemed little doubt, since Albemarle's sewage came not only from 11,243 inhabitants but from 17 textile plants and other industries. This sewage was entering Long Creek at the rate of 1,000,000 gal. per day, and the natural dilution is not very much in the summer months because of small stream flow.

To finance the improvement a 45 per cent PWA grant was secured. This was supplemented by $154,000 in municipal bonds, to be retired out of Albemarle's regular debt service levy, such bonds maturing serially up to 1955. William C. Olsen, consulting engineer of Raleigh, N. C., was commissioned to design and supervise construction of the project, and actual construction began January 6, 1937, with N. D. Pierson, of Raleigh, N. C. as resident engineer for William C. Olsen. The contract price for the project was $249,540.73, the successful bidder being Blythe Bros. Co. Inc., Charlotte, N. C. who had as their construction superintendent F. W. Lee of Charlotte.



**Albermarle's Wastes Disposal Plant.**
*Left to right—The Incinerator; Sludge Digesters and Building; Control Building and Laboratory; Primary Clarifiers and Trickling Filter.*

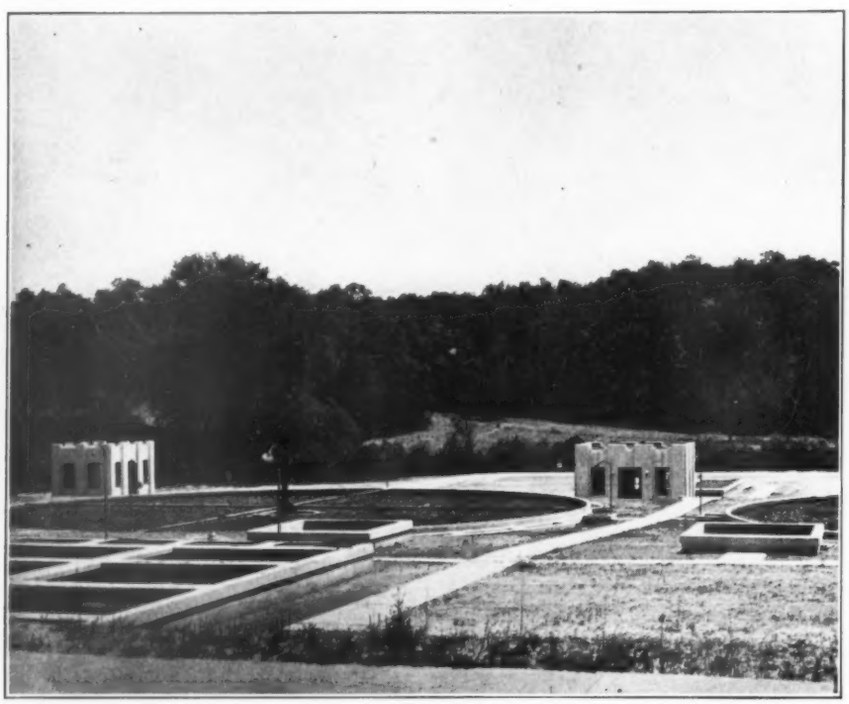
### *The Plant*

Sewage is delivered by a 21 in. sewer and enters the plant through a Simplex Flume Meter from which a record of flow is transmitted to the control building by Simplex equipment. Ahead of the metering station are placed manually operated flood control valves. These valves provide a means to by-pass the plant in times of emergency. The plant was designed to treat 1,750,000 g. p. d. but has been operated far in excess of this rate, with satisfactory results realized.

From the metering flume the sewage passes through either a manually cleaned bar screen or two Chicago Automatic Comminutors and into a pump well.

Into the large manhole above mentioned all the raw sewage is pumped from the pumping station. All the supernatant liquor from the digesters can be drawn off by gravity to this manhole. And, all of the chemical precipitated sludge from the secondary basins is pumped back to this manhole where it mixes with raw sewage and helps to settle sludge from raw sewage. In this manhole a Wallace & Tiernan Chlorinator provides prechlorination or split treatment. And Wallace & Tiernan dry feed machines deliver alum or lime to this manhole as the flash mixer beyond the trickling filters.

The two rectangular primary settling basins have flat bottoms, with sludge collecting hoppers at the influent end. Each basin is equipped with a Link Belt "Straight-Line" type mechanism for continuous sludge collection and basin skimming. However, little scum has been encountered in the basins at any time during plant operation. All solids that settle out in the primary units are drawn off by gravity into a pump pit in the digester building. These solids are left in this pit until they are well settled and then pumped into the digesters, the top water being pumped back to the manhole at the head of the primary basins.



**A View From the Digesters**

Two De Laval centrifugal raw sewage pumps are used to pump the raw sewage against a 40 ft. head into a large manhole at the head of the primary settling basins. The smaller of these two pumps (15 H. P.) delivers from 350 to 700 g. p. m. while the larger unit (25 H. P.) delivers from 700 to 1400 g. m. p. These two units are controlled automatically by a General Electric automatic float switch and switch board, and will operate at speeds to pump sewage at the same rate that it is received in pump well.

Two dosing tanks receive the pre-settled sewage from the primary basins. These dosing tanks are each equipped with interlocking automatic Pacific Flush Tank Co. siphons. These concrete tanks are so constructed that one or both can be used to dose the two trickling filters.

The two reinforced concrete circular trickling filters are each 105 ft in of crushed stone. These filters are equipped with Pacific Flush Tank Co., mercury seal type, rotary distributors.

The effluent from the filters is dosed with either alum, lime, or both at the same time, prior to entering an 18 inch Duplex Turbo Flash Mixer. This flash mixer also mixes the chlorine added to the secondary side of the plant.

Over a long weir the sewage flows into the flocculation basin, where mechanical floc formation is provided by a Dorico Flocculator. The series of sweeping, rolling motions builds up the floc into uniform size so that it settles at a uniform rate.

The coagulated sewage flows from the flocculator basin flows by gravity into the secondary settling basins. These two basins are each rectangular (12 ft x 50 ft.) and are equipped with Link Belt "Straight-Line" collectors. All chemical precipitated sludge that collects in these hoppers is pumped by a 140 g. p. m. Ralph B. Carter sludge pump back into the manhole at the head of the primary settling basins. The clear sterilized effluent from these secondary basins flows over a weir and is discharged into Long Creek.

### *Sludge Treatment and Accessory Processes*

Two sludge digesters of 38 ft. in diameter are used. Between these two tanks is a building housing all the equipment needed for their operation. Both tanks are equipped with Downes Floating Covers, built by the Pacific Flush Tank Co. Hot water coils are suspended in each tank and an Ideal gas-fired boiler is used. The accessories include flame traps, regulating valves, metering equipment, circulating water pumps, and gas metering equipment. Normally all raw sludge is drawn by gravity to the pump pit in this

digester building. This sludge is then pumped into either digester. Supernatant liquor can be drawn off by gravity until a depth of three feet is reached. After that depth is reached the supernatant must be drawn off through valves, provided at various depths. From this pit a Carter sludge pump (140 g. p. m.) pumps direct to the digesters or back to the main manhole. All digested sludge is drawn off by gravity from a connection that is located at the bottom of the hopper shaped circular digester.

An industrial track has been laid through the sludge drying beds and side-dump cars are used to remove dried sludge from the beds. There are six open rectangular (26 ft. x 80 ft.) drying beds constructed of concrete which have the necessary gravity drainage through their sand beds. The dried sludge is at present being used as a soil improver.

Gas from the digesters is used to heat the recirculated water, for laboratory use and in the operator's cottage. Each digester is equipped with a gas dome for collection.

***Refuse Disposal***

The Pittsburgh De Moines Steel Co., incinerator can handle 30 or more tons of mixed refuse daily. It has a 60 ft. brick chimney and is equipped with preheater and blower. Construction is the same as that of other buildings of the plant. It is taking care of rubbish that for years had been hauled to the trash pile in South Albemarle.

***Plant Beautification***

The plant buildings consisting of pump station, control building, flocculator and flash mixer building, sludge treatment building, and incinerator, are all of architectural concrete. This type of construction seemed best to express the simple, modern lines desired, and at the same time effect low maintenance cost.

The plant is built on a hillside and proper landscaping has been taken into consideration. Terraces, tile drains, storm sewers, and concrete walks have been placed to provide the necessary drainage and walkways. All electric wiring is of underground parkway cable, controlled from the control building. All valves have underground valve boxes. Grass and shrubbery is placed to give the plant a park-like atmosphere.

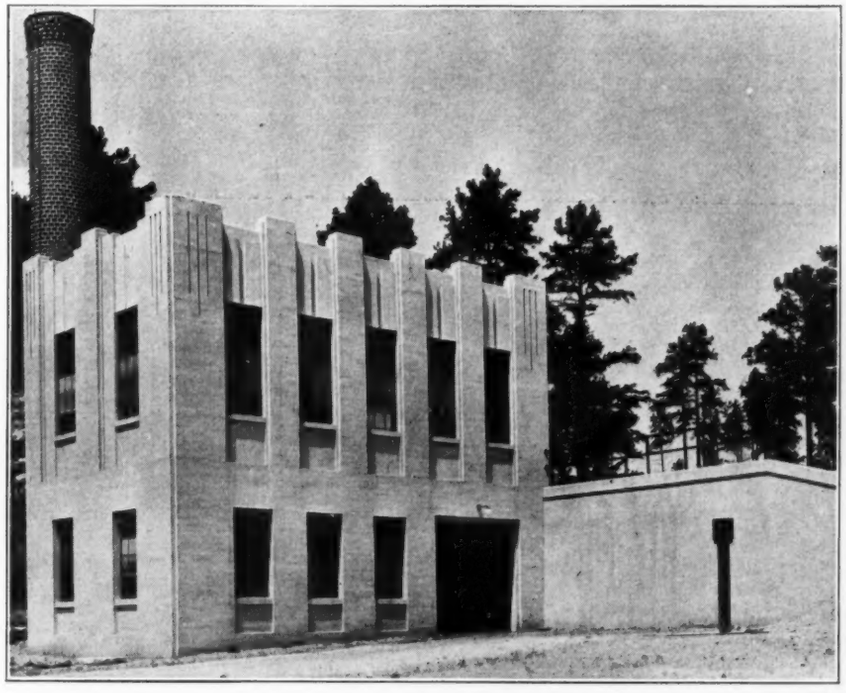
***Miscellaneous***

A special power line, with proper step down transformers was constructed and directly connected to the Albemarle electric distribution system. The same is true with the water supply. A six inch main was laid and hydrants placed conveniently over the entire plant site.

The main control building houses the Wallace & Tiernan chlorinator and dry feed machines along with necessary chemicals. All laboratory equipment is in the south wing of the building. It is modernly equipped, having everything necessary to carry on the various tests and experiments that the State Health Department requires. Some of the equipment consists of the following: Phipps & Bird Inc. combined refrigerator and 20 degree B. O. D. incubator, Arthur H. Thomas 37½ degree incubator, Henry Troemner scales, Freas Thermo-electric 103 degree drying oven, Hoskins electric furnace, W. J. Gilmore Co. evaporating tank, Precision Scientific Co. autoclave, built in glass fume hood, automatic American Gas Products corporation water heater and the Kewaunee Mfg. Co furnished all slate and laboratory fixtures. Centrally located in this building is an electric switch board controlling all lights and power to the other buildings and grounds.

When the City of Albemarle officially accepted the new Sewage Treatment Plant it was fortunate in having men who were intelligent and capable of absorbing details which play an important part in the operation of a plant so highly mechanized. Many problems have been ironed out and the plant is producing excellent results. At the present time the treatment is removing approximately 90 per cent of the total suspended solids and effects an 80 to 95 per cent B. O. D. reduction.

It is planned at a later date to present "Operating Experiences" at this plant, as most all processes have been charted and are being kept for reference. The plant is a part of the Town of Albemarle's Public Utility System and is operated under the direction of the writer as General Superintendent H. D. Fesperman is chemist in charge of all laboratory work connected with both water and sewage plants. H. M. Leonard is Chief Operator and lives in a cottage at the edge of plant site.



**The P.D.M. Rubbish Incinerator.**
*Note excellence of concrete work and pleasing appearance of architectural concrete work.*

The War Department, has awarded a contract to Koppers Co. for six slide gate valves of a special bronze alloy to resist the corrosive effect of polluted water in the new Mahoning flood control dam above Pittsburgh. Each gate will be 10 ft. x 5 ft., 8 in.

# "FLEXIBLE SEWER-ROD" EQUIPMENT AS A PIPE PLUG

By JAMES S. GOFF
Supt. of Sewers
HYANNIS, MASS.

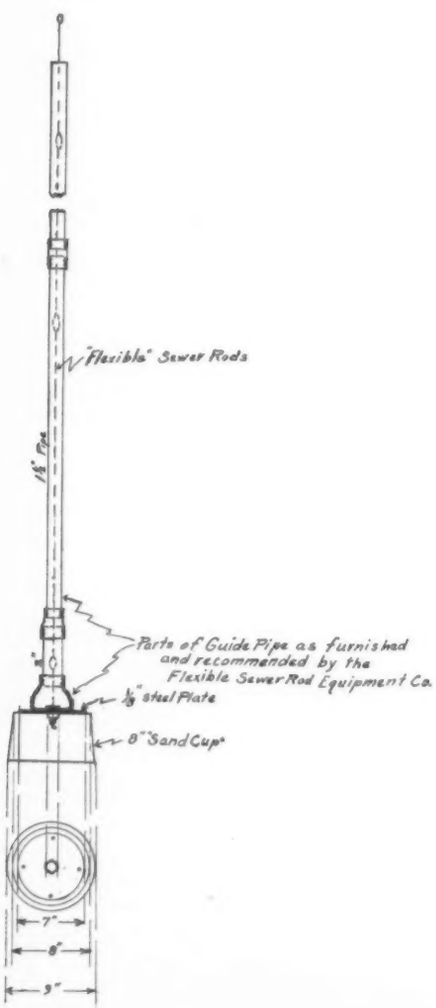
WHEN it became necessary to replace the valve stems in the valves controlling sludge draw-off, which had been damaged unknowingly during installation, it was desirable to plug the sludge pipe between the inlet and the valves so as to remove pressure on the valves. The only alternative would have been to draw down the level of the contents of the Imhoff tank to the level of the valves, a method highly undesirable at any time and much more so in December, as in this particular case.

Since the location of Hyannis, Mass. is such that plugs etc. are not readily available in 8 inch sizes nearer than Boston, some 80 miles distant, I thought I would try using materials available. I had a 7 inch washer made out of ⅛ inch steel plate at a local machine shop, as well as two 12x3x¼ inch bars drilled to fit across the flange of an 8 inch pipe. I then took the 8 inch "sand-cup", sold by the Flexible Sewer-Rod Equipment Co. of Los Angeles, California, and replaced the small washer from the back of the cup with the 7 inch washer which I had made. This covered the small holes in the back of the sand-cup. Then Flexible Sewer-Rods were attached and 1½ in. pipe, with the fittings as shown on the accompanying sketches, was slipped over the rods.

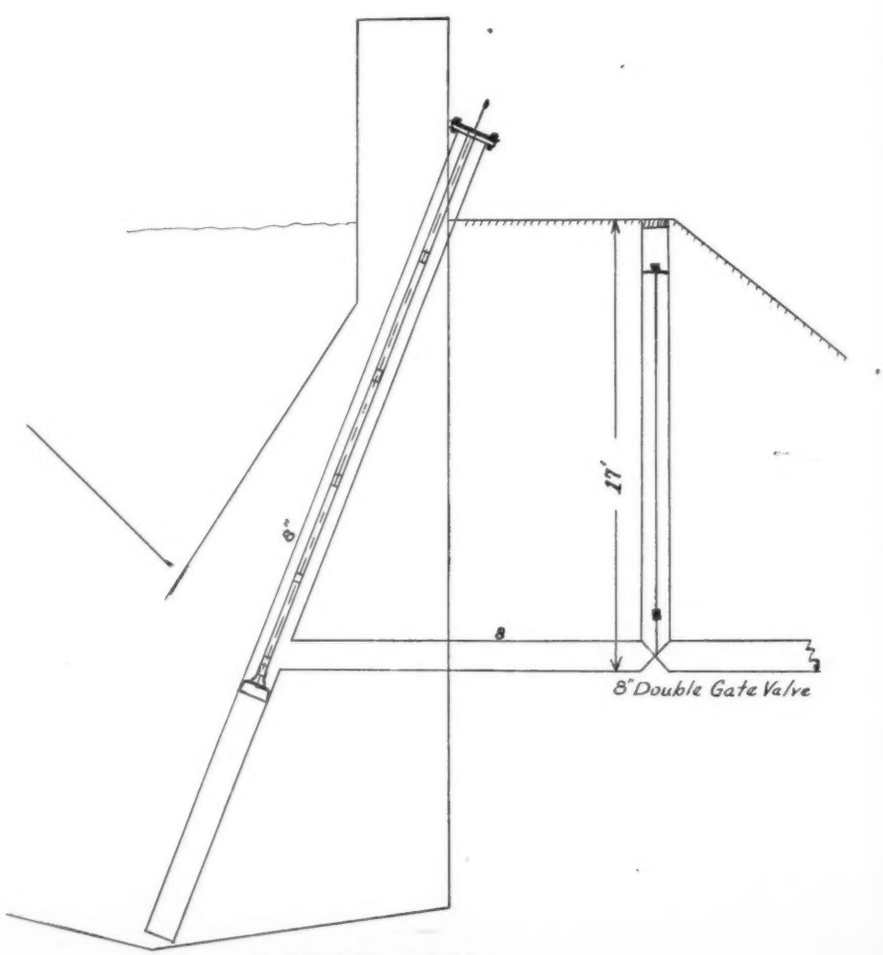
The whole contrivance was then forced down the 8 inch cleanout pipe to a point below the Y-branch leading to the valve (see sketch of tank). Pressure difficulties were overcome by pouring water in behind the sand-cup. When the plug was in position the aforementioned bars were fastened across the end of the cleanout pipe to hold the plug in place by means of the 1½ in. pipe which rested against the bars.

The valves were then cracked to allow the water poured in, and leakage, to drain off and to make sure the plug was working. When drainage ceased the stem in the valves was replaced without difficulty. The whole operation took but a short time and the loss of sludge from the Imhoff tank was negligible. Of course the valve had to be made accessable by digging down to it.

This same rig should work if it became necessary to block a sewer for a time at a point upstream from a manhole, the same principle being applied to the proper sized sand-cup. The rods are attached to insure removal of the plug and the pipe is used to place and hold the plug in position. This scheme may also find application in connection with water works practice.




Details of Sewer Rod Plug.




Sketch of Imhoff Tank.

# SEWER FLOW

## *A Discussion of Principles, With Data to Simplify Calculations*

By JOHN D. WATSON
Consulting Engr.
Ruislip, Middlesex, England

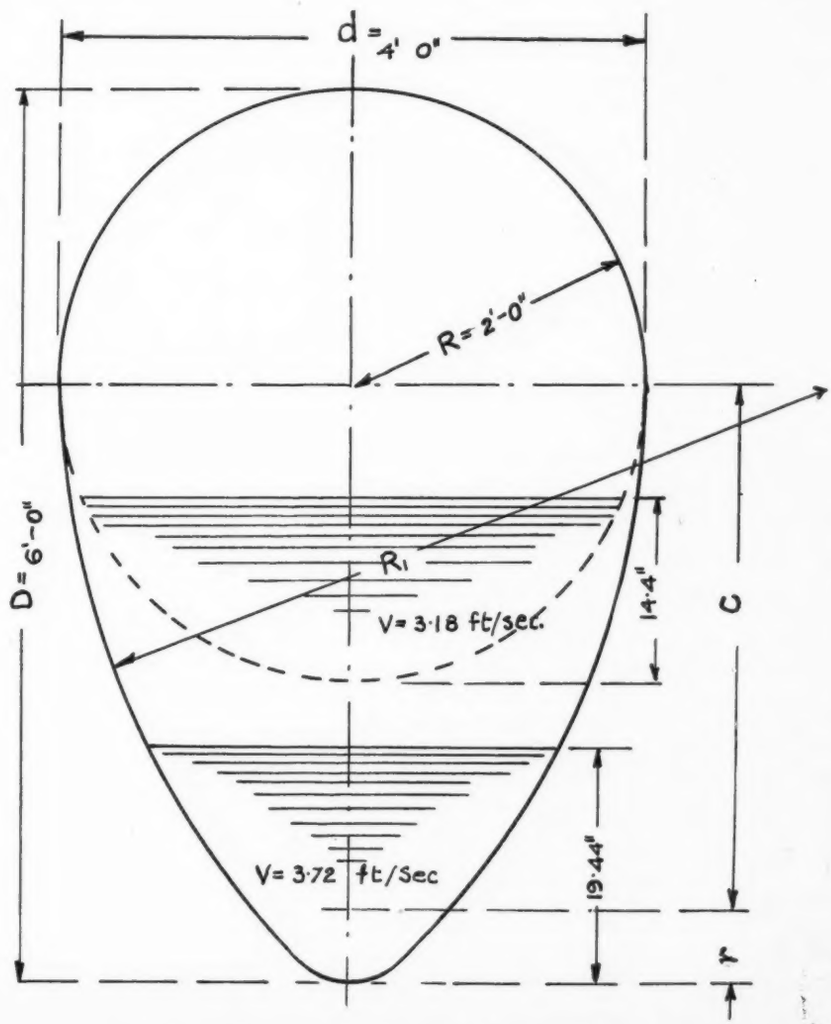
BASICALLY, flow in a sewer is the same as that in any other conduit not operating as a closed conduit or pipe under pressure. That is to say flow takes place by the action of gravity by virtue of the fall or grade, as it may be termed. That again, is affected to a greater or lesser extent by the resistance to the passage of the liquid by that part of the sewer below the level of the stream flowing in it, termed the wetted perimeter which brings the hydraulic mean depth or hydraulic radius (appearing as "r" in most formulae) into the calculations. Hydraulic engineers have long appreciated the reliability of formulae originating with Kutter, Chezy, Williams and Hazen, and others, and while no extreme accuracy is claimed for such calculations, they do serve the practical purpose of estimating the discharge of sewers perfectly well. That is one side of the question.

The other problem is one which requires the engineer to decide upon a suitable size of sewer for a given duty. If all the surface water is excluded by a separate system, the prospective population to be connected to any sewer can be estimated with tolerable accuracy and then the contribution to the drainage system, or any section of it, can be taken as approximating the water consumption per capita. The problem becomes more complicated when surface water enters the sewer and requires the sewer to cope with the run-off from a given "built-up" area. That again would be a simple matter if it were not for the incidence of sudden storms. Sewers cannot, for economic and other reasons, be made large enough to cope with sudden downpours for a couple of hours or more, and the best that can be done in practice to prevent the sewers being loaded to a pressure which might burst them is to provide storm overflows at suitable points to carry off storm water into the nearest watercourse. Such relief overflows are usually designed to come into play when the flow exceeds six times the estimated dry weather flow. Thus, a circular sewer can be designed to carry this amount when running half full, or an over sewer when running two-thirds full. Above such levels the overflow weirs should come into play.

### *A Chief Design Problem*

One of the main difficulties encountered in sewer design is to have a sewer flowing with sufficient velocity under normal D.W.F. conditions to maintain a self-cleansing condition, and yet be able in the first place to cope with a gradually increasing population, and in the second case to carry off the required storm water and still not suffer distress in heavy storms.

There is no direct means of estimating the size of a sewer which will meet these requirements. The best that can be done is to arrive at it by the trial and error method and through experience, increasing the fall of those sewers (usually the branches), which would be flowing sluggishly, and therewith adjusting the depth of the main sewers to render this possible, or by an adjustment of size or both. Even so, bad conditions in the smaller sewers may have to be corrected by periodical flushing.




Depth of Flow and Velocities Refer to Examples in Text.

**Table I.—Factors for Circular Sewers**

| Dia.: Inches | (K) | (A) | (KA) |
|---|---|---|---|
| 12 | 43.15 | 0.7854 | 33.89 |
| 15 | 50.96 | 1.227 | 62.54 |
| 18 | 58.24 | 1.767 | 102.91 |
| 21 | 65.09 | 2.405 | 156.54 |
| 24 | 71.75 | 3.142 | 229.44 |
| 27 | 77.80 | 3.975 | 309.30 |
| 30 | 83.65 | 4.91 | 310.74 |
| 33 | 89.34 | 5.94 | 430.60 |
| 36 | 94.90 | 7.07 | 670.75 |
| 39 | 100.80 | 8.295 | 836.14 |
| 42 | 105.30 | 9.620 | 1013.10 |
| 45 | 110.4 | 10.044 | 1219.25 |
| 48 | 115.4 | 12.566 | 1440.11 |

The tables which accompany this article enable the depth of flow and the velocity in sewers, when carrying a definite volume of water, to be calculated in a simple and reliable manner so that their working condition can be visualized and the whole scheme laid out to its best advantage.

### *Some Examples of Computations*

Referring first to Table (I) this will be seen to refer to the more usual sizes of pipe sewer. The first column gives the pipe bore, the second a constant multiplier (K), the third the sectional area of the pipe (A), while the fourth, which contains tabulating values of (KA), saves time in estimating $Q_1$, which is equal to $\frac{KA}{\sqrt{L}}$ In this formula L is the length of the sewer in feet in which it falls one foot in grade. The first calculation is to find $V_1 = \frac{K}{\sqrt{L}}$ and then $Q_1$, both of which relate to the pipe running full. Such values are not of primary interest, however, because no sewers should run full unless they are storm sewers designed to do so and built to stand some internal pressure. The more important values in the present connection are ($V_2$) and ($Q_2$). The first is the ratio of average velocity in the pipe when the depth over the invert is 1/n of the diameter, to the average velocity when the pipe is running full but *not* under pressure. The second ($Q_2$) is the ratio of the discharge of the pipe, with a depth over the invert 1/n to discharge when running full, but again not under pressure. In Table (II) certain values of ($Q_2$) and ($V_2$)—shown as (q) and (v)—are given for various values of 1/n.

**TABLE II**
**Values for Computing Design of Circular Sewers**

| 1/n | v | q | 1/n | v | q |
|---|---|---|---|---|---|
| ·01 | ·1629 | ·0002756 | ·17 | ·6455 | ·07273 |
| ·02 | ·2299 | ·001097 | ·18 | ·6625 | ·08299 |
| ·03 | ·2808 | ·002455 | ·19 | ·6787 | ·08973 |
| ·04 | ·3232 | ·004337 | ·20 | ·6947 | ·09908 |
| ·05 | ·3607 | ·006741 | ·21 | ·7099 | ·1084 |
| ·06 | ·3944 | ·009663 | ·22 | ·7246 | ·1182 |
| ·07 | ·4249 | ·01307 | ·23 | ·7403 | ·1286 |
| ·08 | ·4531 | ·01698 | ·24 | ·7526 | ·1357 |
| ·09 | ·4794 | ·02137 | ·25 | ·7658 | ·1496 |
| ·10 | ·5041 | ·02624 | ·26 | ·7789 | ·1610 |
| ·11 | ·5274 | ·03156 | ·27 | ·7914 | ·1724 |
| ·12 | ·5494 | ·03736 | ·28 | ·8056 | ·1846 |
| ·13 | ·5705 | ·04359 | ·29 | ·8155 | ·1963 |
| ·14 | ·5905 | ·05025 | ·30 | ·8269 | ·2093 |
| ·15 | ·6095 | ·05729 | ·31 | ·8381 | ·2213 |
| ·16 | ·6279 | ·06485 | ·32 | ·8489 | ·2342 |
| ·33 | ·8596 | ·2480 | ·67 | 1·080 | ·7691 |
| ·34 | ·8698 | ·2608 | ·68 | 1·083 | ·7839 |
| ·35 | ·8798 | ·2747 | ·69 | 1·086 | ·7993 |
| ·36 | ·8896 | ·2882 | ·70 | 1.088 | ·8134 |
| ·37 | ·8991 | ·3024 | ·71 | 1·091 | ·8283 |
| ·38 | ·9080 | ·3166 | ·72 | 1·093 | ·8426 |
| ·39 | ·9170 | ·3311 | ·73 | 1·095 | ·8567 |
| ·40 | ·9258 | ·3458 | ·74 | 1·097 | ·8706 |
| ·41 | ·9342 | ·3606 | ·75 | 1·098 | ·8835 |
| ·42 | ·9426 | ·3757 | ·76 | 1·100 | ·8971 |
| ·43 | ·9501 | ·3904 | ·77 | 1·101 | ·9097 |
| ·44 | ·9583 | ·4060 | ·78 | 1·102 | ·9223 |
| ·45 | ·9656 | ·4214 | ·79 | 1·103 | ·9344 |
| ·46 | ·9729 | ·4368 | ·80 | 1·104 | ·9466 |
| ·47 | ·9802 | ·4526 | ·81 | 1·104 | ·9576 |
| ·48 | ·9870 | ·4688 | ·82 | 1·104 | ·9687 |
| ·49 | ·9936 | ·4842 | ·83 | 1·104 | ·9790 |
| ·50 | 1·000 | ·5000 | ·84 | 1·103 | ·9900 |
| ·51 | 1·007 | ·5163 | ·85 | 1·102 | ·9984 |
| ·52 | 1·013 | ·5322 | ·86 | 1·100 | 1·007 |
| ·53 | 1·018 | ·5476 | ·87 | 1·099 | 1·015 |
| ·54 | 1·024 | ·5641 | ·88 | 1·097 | 1·023 |
| ·55 | 1·029 | ·5797 | ·89 | 1·094 | 1·029 |
| ·56 | 1·035 | ·5964 | ·90 | 1·091 | 1·031 |
| ·57 | 1.040 | ·6124 | ·91 | 1·088 | 1·040 |
| ·58 | 1·045 | ·6287 | ·92 | 1·085 | 1·044 |
| ·59 | 1·049 | ·6439 | ·93 | 1·081 | 1·047 |
| ·60 | 1·054 | ·6619 | ·94 | 1·076 | 1.051 |
| ·61 | 1·058 | ·6759 | ·95 | 1·071 | 1·051 |
| ·62 | 1·062 | ·6915 | ·96 | 1·065 | 1·051 |
| ·63 | 1·066 | ·7074 | ·97 | 1·056 | 1·047 |
| ·64 | 1·070 | ·7231 | ·98 | 1·046 | 1·043 |
| ·65 | 1·074 | ·7391 | ·99 | 1·032 | 1·030 |
| ·66 | 1.077 | ·7543 | 1·00 | 1·000 | 1·000 |

Applying this data to a 12-in. sewer, laid at 1/500 grade, to carry 60,000 gallons per day. If that was 6 times the D.W.F. the latter would be 10,000 gallons per day and assuming the water consumption per capita to be 30 gallons per day the sewer would serve say 300 persons

**Table III.—Factors for Oval Sewers**

| Size | K | A | KA |
|---|---|---|---|
| 5′-3″ x 3′-6″ | 104.8 | 9.259 | 970.4 |
| 5′-6″ x 3′-8″ | 108.2 | 10.161 | 1099.5 |
| 5′-9″ x 3′-10″ | 111.6 | 11.106 | 1287.3 |
| 6′-0″ x 4′-0″ | 148.8 | 12.090 | 1388.0 |
| 6′-3″ x 4′-2″ | 118.1 | 13.122 | 1550.0 |
| 6′-9″ x 4′-6″ | 124.3 | 15.305 | 1902.5 |
| 7′-0″ x 4′-8″ | 127.5 | 16.460 | 2098.6 |
| 7′-3″ x 4′-10″ | 130.4 | 17.656 | 2292.3 |
| 7′-6″ x 5′-0″ | 133.6 | 18.90 | 2524.4 |
| 7′ 9″ x 5′-2″ | 139.6 | 20.176 | 2816.6 |
| 8′-0″ x 5′-4″ | 141.0 | 21.50 | 2131.2 |
| 8′-3″ x 5′-6″ | 142.2 | 22.9 | 3251.1 |
| 8′-6″ x 5′-8″ | 145.1 | 24.25 | 3521.6 |
| 8′-9″ x 5′-10″ | 148.0 | 25.72 | 3796.25 |
| 9′-0″ x 6′-0″ | 150.9 | 27.2 | 4105.8 |

or 60 average houses. Reducing 60,000 g.p.d. to Cusecs* $= 0.110$, and $Q_1 = \frac{KA}{\sqrt{L}}$. From Table I KA for a 12″ pipe = 33.890, therefore $Q_1 = \frac{33.890}{\sqrt{500}} = 1.55$ cusecs.*

The proportional discharge $= \frac{0.110}{1.55} = 0.0714 = Q_2$. Referring to Table II the nearest value of $Q_2$ shows the appropriate value of $\frac{1}{n} = 0.17$.

Multiplying the pipe diameter (12) by 0.17 the result is 2.04, which is the inches depth of flow over the invert. Velocity when running full is $V_1 = \frac{K}{\sqrt{L}} = \frac{43.15}{\sqrt{500}} = 1.97 = V_2$

In Table II the nearest value of $V_2$ corresponding to $Q_2 = 0.0714$ is 0.6455 and 1.97 x 0.6455 = 1.25, which is the velocity when discharg-ign 0.110 cusecs.

The calculation, therefore, shows that the 12-in. sewer laid at 1/500 has a low velocity of but 1.25 ft./sec which is hardly sufficient to maintain it in a clean condition. That might be anticipated because 1/300 is about the flattest grade on which it is advisable to lay in 12-in. pipe, for 15-in. pipe the limit could be put at 1/400, for 18-in. pipe 1/500, 21-in. 1/600, 24-in. 1/700, 27-in. 1/800 and 30-in. 1/900. It will be observed, too, that the depth of flow over the invert is small (only a fraction over 2-in.) and in the carrying away of solid matter, the depth of flow is important. For that reason, large sewers which have a velocity of but 1.5 miles per hour keep quite free from deposits because they will be operating with at least 12-in. or so of depth over the invert.

In a case like that just illustrated, it may be possible by lowering the depth of the main, at the expense of

[*"Cusecs" is the expressive term of the British engineer for cubic feet per second.—Ed.]

**TABLE IV**
**Values for Computing Design of Oval Sewers**

| 1/n. | v′ | q′ | 1/n. | v′ | q′ |
|---|---|---|---|---|---|
| ·01 | ·1662 | ·0003352 | .18 | ·6483 | ·09877 |
| ·02 | ·2410 | ·001462 | ·19 | ·6619 | ·1090 |
| ·03 | ·2975 | ·003353 | ·20 | ·6751 | ·1199 |
| ·04 | ·3421 | ·005921 | ·21 | ·6879 | ·1311 |
| ·05 | ·3797 | ·009154 | ·22 | ·6971 | ·1422 |
| ·06 | ·4159 | ·01307 | ·23 | ·7062 | ·1538 |
| ·07 | ·4430 | ·01726 | ·24 | ·7210 | ·1669 |
| ·08 | ·4722 | ·02243 | ·25 | ·7300 | ·1796 |
| ·09 | ·4946 | ·02781 | ·26 | ·7398 | ·1929 |
| ·10 | ·5194 | ·03394 | ·27 | ·7489 | ·2078 |
| ·11 | ·5379 | ·04029 | ·28 | ·7598 | ·2208 |
| ·12 | ·5568 | ·04724 | ·29 | ·7702 | ·2357 |
| ·13 | ·5727 | ·05450 | ·30 | ·7802 | ·2509 |
| ·14 | ·5916 | ·06266 | ·31 | ·7881 | ·2659 |
| ·15 | ·6068 | ·07099 | ·32 | ·7960 | ·2813 |
| ·16 | ·6198 | ·07958 | ·33 | ·8050 | ·2975 |
| ·17 | ·6357 | ·08910 | ·34 | ·8139 | ·3143 |
| ·35 | ·8224 | ·3311 | ·68 | 1·004 | 1·030 |
| ·36 | ·8294 | ·3480 | ·69 | 1·008 | 1·054 |
| ·37 | ·8375 | ·3657 | ·70 | 1·010 | 1·077 |
| ·38 | ·8455 | ·3837 | ·71 | 1·014 | 1·101 |
| ·39 | ·8517 | ·4015 | ·72 | 1·017 | 1·124 |
| ·40 | ·8592 | ·4200 | ·73 | 1·020 | 1·147 |
| ·41 | ·8668 | ·4394 | ·74 | 1·022 | 1·169 |
| ·42 | ·8736 | ·4582 | ·75 | 1·025 | 1·193 |
| ·43 | ·8822 | ·4817 | ·76 | 1·028 | 1·215 |
| ·44 | ·8861 | ·4969 | ·77 | 1·030 | 1·238 |
| ·45 | ·8928 | ·5171 | ·78 | 1·032 | 1·260 |
| ·46 | ·8989 | ·5370 | ·79 | 1·034 | 1·281 |
| ·47 | ·9055 | ·5584 | ·80 | 1·035 | 1·302 |
| ·48 | ·9118 | ·5790 | ·81 | 1·037 | 1·322 |
| ·49 | ·9175 | ·6002 | ·82 | 1·038 | 1·342 |
| ·50 | ·9221 | ·6207 | ·83 | 1·039 | 1·361 |
| ·51 | ·9279 | ·6424 | ·84 | 1·039 | 1·379 |
| ·52 | ·9344 | ·6646 | ·85 | 1·040 | 1·398 |
| ·53 | ·9387 | ·6855 | ·86 | 1·040 | 1·416 |
| ·54 | ·9441 | ·7079 | ·87 | 1·040 | 1·432 |
| ·55 | ·9491 | ·7302 | ·88 | 1·039 | 1·446 |
| ·56 | ·9539 | ·7521 | ·89 | 1·038 | 1·459 |
| ·57 | ·9590 | ·7754 | ·90 | 1·036 | 1·474 |
| ·58 | ·9636 | ·7979 | ·91 | 1·034 | 1·486 |
| ·59 | ·9681 | ·8206 | ·92 | 1·032 | 1·497 |
| ·60 | ·9714 | ·8424 | ·93 | 1·028 | 1·504 |
| ·61 | ·9770 | ·8668 | ·94 | 1·025 | 1·511 |
| ·62 | ·9813 | ·8898 | ·95 | 1·021 | 1·517 |
| ·63 | ·9854 | ·9131 | ·96 | 1·016 | 1·519 |
| ·64 | ·9893 | ·9361 | ·97 | 1·010 | 1·520 |
| ·65 | ·9931 | ·9596 | ·98 | 1·002 | 1·515 |
| ·66 | ·9970 | ·9833 | ·99 | ·9893 | 1·592 |
| ·67 | 1·000 | 1·007 | 1·00 | ·9588 | 1·459 |

the available fall in it of course, to get better conditions for the branch. If that is not possible, and assuming 12-in. to be the minimum size desirable, it will be necessary to arrange for periodic flushing by an automatic syphon-operated flush tank, because while oval pipe is available it is seldom used for small diameter sewers.

### *Consideration of Oval Design*

Turning now to the matter of the oval for the large built sewers, the diagram and Tables III and IV give certain useful data in connection with this form of sewer in terms of the principal dimension (R). In considering the diameter (D) however, the velocity in a conduit is proportional to the square root of the H.M.D. or "r" as it appears in most formulae while the discharge (Q) varies as (A/r). Then, in order than an oval sewer when flowing two-thirds full shall have the same theoretical discharge as a circular sewer of diameter (d) flowing half full the horizontal diameter (d) of the oval or egg shape section should be equal to 0.752 of the corresponding circular sewer. (Reference to diagram.)

| | |
|---|---|
| Horizontal diameter...d | = 2R |
| Vertical diameter ....D | = 3R |
| Radius of bottom arc..r | = ¼R |
| Radius of side arcs..R1 | = 2.66 R |
| Distance between centres .....C | = 1.75. R |
| Wetted perimeter full.. | = 7.841.R |
| Wetted perimeter 2/3 full ..... | = 4.7. R |
| Wetted perimeter 1/3 full ..... | = 2.665.R |
| Area of flow full..... | = 4.46 $R^2$ |
| Area of flow, 2/3 full.. | = 2.89. $R^2$ |
| Area of flow, 1/3 full.. | = 1.017 $R^2$ |
| H.M.D. full ..... | = 0.569 R |
| H.M.D. 2/3 full..... | = 0.515 R |
| H.M.D. 1/3 full..... | = 0.382 R |

At one time egg shape sewers were built in relatively small sizes, though they are now rarely constructed in dimensions of less than 5-ft. high x 3½-ft. wide. In Table (III) the corresponding sectional area (A), values of (K) and of (K A) are given as they apply to oval sewers of the sizes listed.

Taking as an example a 6-ft. by 4-ft. sewer of this type it is assumed to be laid at a fall of 1-900 and is required to discharge 10-cusecs. That, on the basis of the previously mentioned 12-in. pipe sewer, will have a sufficient capacity to serve six times the D.W.F. of 30,000 persons, or a town of average size on the assumption that any excess is carried off by relief sewers.

The discharge running 2/3 full = $\frac{KA}{\sqrt{L}} = \frac{1380}{30} = 46.3$ cusecs = $Q^1$,

The proportionate discharge = $\frac{10}{46.3}$ = 0.215. In table (IV) the appropriate value of 1/n to q = 0.215 is 0.27. Therefore the depth of flow over the invert = 0.27 x 72 = 19.44-in. The velocity when running 2/3 full = $\frac{K}{\sqrt{L}} = \frac{148.8}{30} = 4.96$ and the velocity when discharging 10 cusecs = v' x 4.96. Opposite 1/n = 0.27 will be found v' = 0.752. Multiplying 4.96 by 0.752 the velocity is found to be 3.72-ft./sec.

Applying the same reasoning to a 48-in. circular sewer, $V_1 = \frac{KA}{\sqrt{L}} = \frac{1440}{30} = 48$. Proportionate discharge = $\frac{10}{48}$ = say 0.21 = q. The corresponding value of 1/n to q = 0.21 is 0.30 in Table II. Therefore 48 x 0.30 = 14.4-in. depth over the invert which is 5-in. less than that in the oval sewer, as might be anticipated. Velocity = $\frac{K}{\sqrt{L}} = \frac{115.4}{30}$ = 3.85. When discharging 10 cusecs the appropriate multiplier found in Table II is 0.827 and multiplying 3.85 by 0.827, the velocity is found to be 3.18-ft./sec. compared with 3.72-ft./sec. for the oval sewer.

The above comparison is interesting. It shows that the oval sewer, as might be anticipated, is flowing with the greater velocity (3.72-ft./sec.) and at a greater depth (19.44-in.) over the invert as compared with 3.18-ft./sec. and 14.4-in. depth in the case of the circular sewer. Taking the maximum capacity of the latter running ½-full, and that of the oval sewer when running 2/3 full, the reserve capacity of the latter is appreciably greater as the diagram will readily indicate. However, such will be had only at the expense of a larger amount of brickwork and a more costly construction. One can therefore conclude that the circular form, especially in view of the large bore concrete pipes which are now available, serves very well when it can be relieved of storm water when running half full. On the other hand, the oval type has the greater reserve capacity when this cannot be provided for. Both sewers will be seen to be running somewhat over ¼-full at their respective depths and in this condition both have a good average velocity at the low fall of 1/900. The depth of flow in each case, too, is sufficient to keep the detritus and gritty materials moving to the grit chambers for deposition.

## "Water Supply Engineering"

(Third Edition — $6.00)

Authors —

Harold E. Babbitt, Professor of Sanitary Engineering

James J. Doland, Professor of Civil Engineering, University of Illinois.

Publishers —

McGraw Hill Book Co., Inc., New York City.

"Water Supply Engineering" as appeared in its third edition. The new text has been considerably revised and enlarged to 690 pages.

The context covers essentially every phase of water supply engineering and water treatment. It begins with methods of financing and ends with methods of water purification. One important chapter, for engineers and operators not thoroughly grounded in applied electricity, is that devoted to electricity in water works practice. The book deals with fundamentals, exemplified with practical applications and working data.

New material in the third edition includes discussions of management, government regulations, legal water rights, and rates. The new material on consumption is based on recent data. The chapters on pumps and pumping have been completely rewritten, with emphasis on selection of equipment and operation. The chapter on distribution systems has been revised and the new Criss-Doland method of computing predictable flows and pressures at various points is included. There are new chapters on softening, sterilization and miscellaneous treatment. And another on the most effective location and construction of wells, a result of rapidly advancing knowledge in this phase of water supply engineering.

It goes without saying so—but, those who have found earlier editions of "Water Supply Engineering" valuable will find the new edition even more so.

# N. E. W. W. A.

## *Discusses Court Decision of Far Reaching Import; Hears Worth of the Water Works "G-Man" Expounded*

THE March meeting of the New England Water Works Association, was attended by very nearly 200 members and guests in spite of weather conditions.

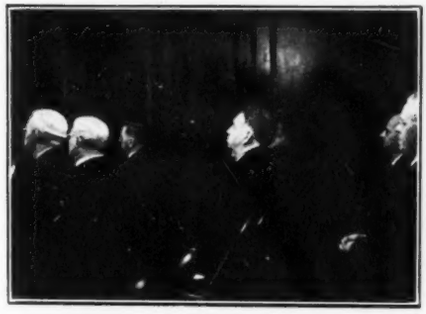
Featured as the Superintendents' Round Table topic were experiences with rate-recorders attached to customers meters for the purpose of settling disputes as to consumption, proving leakage or waste on the premises of the customer, leakage on main extensions, selection of proper size meters for services, and the like.

In the room adjoining, the chemists round tabled on "interesting and unusual analyses." And, the after-lunch program was devoted to the pollution of wells and methods of safeguarding ground water supplies and providing well protection. Near the close an unprogrammed review of the recent decision of the Supreme Court of Massachusetts, holding a municipality responsible for lead poisoning of a consumers family, proved the most interesting topic of the afternoon. It created considerable speculation and discussion as to the far reaching significance of the decision which held that the water department was negligent in not having corrected the aggressivity of the water toward lead service pipes, and/or not having warned the customer of the dangers of the long run of lead pipe.

### *The Water Works School*

Preceding the morning's Round-Tables, the customary Water Works School was held. To pinch-hit for Professor George E. Russell of the Mass. Institute of Technology came his able assistant, Dr. Ken Reynolds, to black-board lecture on "Flows and Friction in Pipe Lines."

Dr. Reynolds defined the commonly used terms, developed those formulae most used in computing friction losses and flow, discussed the effects of elbows, bends, valves and fittings on friction loss. The value of long radius bends was illustrated by citing the fact that for sizes 1 to 12 inch in diameter friction losses in 90 degree elbows became twice those



**Class — The Water Works School**

*On the front row sit "Seniors" Bristol (Ansonia) and Weston (Boston); on the next Gidley (Fairhaven); on the third we recognize Wellington (New Haven).*

for long radius bends. He referred his listeners to a recent publication of the U. S. Bureau of Standards, *"Pressure Losses in 90 Degree Pipe Bends"* (July 1938) which constitutes a collection of the most reliable data available.

### *Supt's. Round Table*

The Chairman—
Clarence B. French, Engineer,
Water Department
Waltham, Mass.

**Round Table Leaders**

*C. B. French, Sup't. Waltham, Mass.* — *Geo. G. Borgen, Engr., Boston, Mass.*

***Topic—Rate Recorders.***

Introducing the first topic, the Chairman gave a few experiences with rate-recorders in Waltham and then called on Sup't. Roger Esty of Danvers, Mass., who had christened these mechanical detectives the "G-Men of the Water Department"—otherwise the "Meter-Master" developed by Frank S. Brainard, Distribution Engineer, Hartford, Conn. Water Department.

Mr. Esty explained the now famous "G-Man" to be a simple, readily portable rate recording instrument for attaching to the spindle of consumers' meters in place, without disturbing or interfering with the registration of the meter. Then the record chart removed after a 24-hour period presented an undisputable proof of what occurs on the customer's side of the meter. In addition to settling disputes over water bills, Mr. Esty cited other interesting applications of the "Meter-Master," such as detecting water waste through hidden leaks on small mains and extensions or dead mains into closed industrial plants. In addition, every large meter on the Danver's system had been checked by the "G-Man" as to correctness of size and performance.

Some of the more interesting cases of consumer waste water uncovered by the "G-Man" included the well known toilet flush handle that has to be jiggled at times to completely stop the water flow and is frequently forgotten when the leakage is not readily noticed. What happened was plainly pictured on the 24-hour charts. Another case of winter waste uncovered was that of a customer's wife who, annoyed by bumping and rumbling of the hot water tank, had found bleeding the hot water faucet at intervals an effective temporary remedy. And, there were others of a similar nature tracked down by the picture the "G-Man" drew, leading to questions and confessions.

Amongst Danver's "happy customers," made so with the aid of the "G-Man", Mr. Esty cited an office building owner who now paid for 71 cu. ft/day as compared to 496 cu. ft./day before the check-up. Then there was a drug store which indirectly saved $5.00 per month on electric motor operation in cellar draining.

MR. FRENCH then cited several representative Waltham cases in which satisfied customers had been the outgrowth of money saved them by the "Meter-Master" check-up. In one instance the customer had become "contented" although he hadn't stopped the leakage shown up by the "G-Man."

W. P. MELLEY, Sup't., Milton, Mass., cited his experience in which a customer so persistently refused to accept a verbal explanation that Milton was forced into buying a "Meter-Master". Fortunately the customer had to temporarily shut off the water to replace washers during the time of the check-up It was this chart record revealing the shut off that convinced him and, incidentally, reduced his quarterly bill from $60. to $14.

GEO. MERRIL, Sup't., Ware, Mass., pointed out that the "G-Man" became the more impressive because the check-up is made on the customer's premises; saved money, because the meter did not have to be taken to the shop for testing.

FRANK S. BRAINARD, Hartford, Conn. stated that the "Meter-Master" in Hartford had resulted in replacement of most of their large meters with smaller units.

***Questions***

To questioners, Mr. Esty replied that more than 5 cu. ft./capita/day of consumption had been found to be an indicator that water waste existed on the premise served. To install the "G-Man" required about one hour (out and back) by the employer doing the job. No charge of any nature was being made for the check up service. Compensation lay in the results attained and improved customer relationship.

MR. FRENCH replied that no difficulty in proving the dependability of the story of the "G-Man's" chart to the customers/ satisfaction was if another chart picturing a tight system was shown at the same time.

***Topic—Collection Under the Lien Law of Massachusetts***

The second topic introduced by Chairman French was that concerning experiences with the Massachusetts law which makes of unpaid water bills a lien against the property served. Mr. French reported that Waltham had found it effective in converting a $3,000 water department deficit into a $17,000 surplus. Out of the 400 metered accounts, 150 liens were placed.

Mr. French explained that the bills had to be 2 to 18 months old and described the procedure in putting on liens, stating that it was essential to determine with assurance the present owner's name, and to provide a brief but exact description of the property for filing and recording with the Registrar. He stated that publicity in the local press, concerning the law and the necessity of employing it, had been very helpful in reducing the number of liens actually placed.

WM. B. DUFFY, Sup't., North Andover, Mass., reported excellent results with the use of lien notices to customers hard to reach in any other manner.

Due to lack of further time the Chairman had to close the discussion at this point when there were seemingly many who had experiences or questions to present.

**Superintendents**

*George Brehm, Amherst, Mass. (Past President of N.E.W.W.A.) F. D. Bradshaw, Sudbury, Mass. Wm. P. Melley, Milton, Mass.*

*Harry E. Holmes, Mass. Dept. Health, Boston. Arthur C. King, Sup't. of Water, Taunton. (Chairman, Legislative Committee) Stuart E. Coburn, Metcalf & Eddy, Boston.*

## *Chemists Round Table*

The Chairman—G. G. Bogren,
Weston and Sampson Eng'rs.
Boston, Mass.

***Topic—Unusual Conditions and Analyses***

Discussion, opened by Chairman Bogren, dealt with unusual conditions and resulting analytical findings which make interpretation of results from water analysis difficult or misleading. Such for instance was high chloride content in some waters and nitrates, such as referred to in Mr. Sherman's paper covered later in this report. Also the matter of erroneous residual chlorine results from the ortho-tolidin method, when manganese or nitrites are present, was discussed.

A. R. G. BOOTH, Mass. Dept. of Health, related an experience with a well supply on Cape Cod troubled with sea water seepage, and the means of correction.

The matter of slow lactose fermenters in water supplies and the question of probable sanitary significance was discussed by several, including Messrs. Adams, McCarthy, Coburn, Scales, Smith and Pratt.

M. S. WELLINGTON, Chemist, New Haven Water Co., related experiences with coagulation difficulties and the beneficial effects of prechlorination observed at New Haven when color runs high. In the discussion ensuing, Prof. E. W. Moore of Harvard Univ., thought it most likely that the negatively charged chlorine attacks and alters the positively charged organic bodies which normally act as coagulation inhibitors.

## *Symposium on Ground Water Supplies*

(Pres. Geo. A. Sampson, Presiding.)

Following luncheon, and a brief business session, it was announced that the April meeting will be held in Willimantic and at Connecticut State College in Storrs, Conn., on April 27th. The group will gather first at the nearby Willimantic Water Plant in the forenoon for inspection and there from proceed to State College.

The afternoon was principally devoted to a group of papers dealing with "Pollution of Ground Water Supplies."

The first paper, that by LESLIE K. SHERMAN, Ass't. Eng'r., Conn. Dept. of Health, constituted a worthy recounting of experiences which proved the fallacy of depending upon regulations fixing distances between pollution hazard and wells, based upon assumed protection of well supplies by natural infiltration or percolation through the soil. It discused methods of well protection and presented the most approved drilling, casing and sealing methods illustrated by lantern slides.

Actual pollution cases were cited in support of recommendations. Interesting was the disclosure that high fertilization of Connecticut Valley tobacco lands resulted in nitrates of 10 to 30 parts per million in well supplies in the valley. Iron content in well supplies had run as high as 48 parts and, interestingly, hydrogen sulphide also appeared in some well waters of Connecticut.

E. J. SULLIVAN, Ass't. Eng'r., Mass. Dept. of Health, in discussing well pollution cases, directed attention to a 6 in. well 200 ft. deep

which had been polluted by a cesspool, the seepage from which had presumably to percolate through 220 ft. of sand, thus proving the inadequacy of dependance on natural percolation. Another case was that of well pollution by industrial dye waste from ponds thought a safe distance removed.

E. W. MOORE, Ass't. Prof. of Sanitary Engineering, Harvard University, presented additional experiences involving pollution of wells by organic industrial wastes.

**Wholesaler & Retailer**

*"Steve" Taylor, Supt. of New Bedford's Water Dep't. (left) and his good customer Donald Sorelle, Supt. of Water at Acushuet, Mass., who retails water bought from wholesaler Taylor.*

## *A Recent Court Decision of Far Reaching Import*

*"The Case of North Attleboro, Mass.,"* highlighted by E. Sherman Chase, proved the most interesting feature of the session and its importance eclipsed whatever discussion might have arisen on ground water supplies.

We here present highlights developed at the meeting, and following that a summary prepared by Mr. Chase especially for the readers of *Waterworks and Sewerage.*

The plaintif, Horton, brought suit against the City of North Attleboro for damages to himself and family due to lead poisoning traceable to the municipal water supply. The Supreme Court of Massachusetts has held the city responsible on the grounds of existing knowledge concerning water quality in respect to lead attack, the dangers of lead poisoning therefrom, and the lack of exercising "reasonable care" in the specific case.

The case as presented for the city hinged on the following claims:

(a) The city could not be held to be responsible for water quality beyond the connection to the city's service at the curb line, i. e., on consumer's property and through consumer's pipes.

(b) In issuing a warning of danger to Horton, hazardous public alarm as to safety of the water would have resulted.

In its findings the court cited a British case decided, in favor of the plaintiff—(see The Surveyor," Sept. 10, 1937)—in which the opinion stated that a common law duty existed beyond the statutory duty of water purveyors. The court (Mass.) emphasized the following as indicative of the lack of "reasonable care" for which the city was held responsible and appeal denied:

(1) The city in employing lead services to the curb, and knowing of the existence of the consumer's lead service, indicated approval of such services.

(2) The consumer should have been adequately warned to provide a safe service material or else to bleed the long service line at proper intervals.

(3) The water had not been given anti-corrision treatment, now known to the profession.

In introducing the lengthy discussion which followed—President Sandborn emphasized the fact that the electrolytic couple, established through the joining of the lead service to copper piping within the residence, had been shown responsible for aggravated solution of the lead, later reduced markedly by inserting an insulating element in the joint.

*"Bill" Sherwood, Vice-Pres. Hersey Meter Co. "Jim" Angell, Jr., "Water Works & Sewerage." "Clint" Inglee, Pres., Nat'l. Water Main Cleaning Co.*

W. W. BRUSH, Editor, "Water Works Engineering"—called attention to the growing responsibility of water purveyors (including cities) in the matter of knowledge of health hazards from water quality, approving service pipe materials, plumbing, etc. He cited the effects of fluorides in water as a case of importance and felt that consumers would in the future be more likely to bring suit than in the past. Once a method of correction is known, the responsibility of the purveyor needs little further proof in the eyes of the courts, was the thought behind these statements.

*W. E. Haywood, Keasby & Matson Co., Ambler, Pa. Jas. O. Jordan, Hedge & Matheis Co., Boston. C. W. Baldwin, Syntron Co., Boston.*

In the general discussion, there was considerable speculation as to the responsibility should the purveyor have adequately warned the consumer—some of it being "off the record" discussion and therefore not recorded here.

FRANK GIFFORD, Sec'y. of N. E. W. W. A., felt certain of one serious weakness in the case of the city and that was that effective treatment had not been instituted.

L. H. ENSLOW, Editor, "Water Works & Sewerage," said that, if he might be permitted to "think aloud," it seemed hardly likely that the U. S. Supreme Court would reverse the Massachusetts decision, even if appeal was ever made. The importance of the case was that courts now had an American precedent on which to hold water utilities for damages due to water quality and failure to exercise "reasonable care." The division wall of responsibility had now been removed from the property line, in respect to health damages at least, and the question was—What next? Damages to property due to corrosive quality of waters or choking of lines, etc., would be next, without much question. Mr. Enslow pointed out that this present case would definitely further attempts now under way in some states to compel water utilities to take full responsibility for delivery of the product into the homes or places of business of consumers, not just to the property line. That would mean responsibility for the service line across the property to the house, just as gas and electric companies were now responsible for conductors into the building proper.

In this direction the case of claims now being brought by organized property owners in one large city against the water department for damaged hot water heaters, due to allegedly inferior water treatment, was cited as indicative of future expectations.

### *New England Section Elects Officers*

At the close of the meeting, the New England Section of A.W.W.A. held a brief meeting for the purpose of electing officers, the following being the slate of the nominating committee which was accepted unanimously.

Chairman—Frank A. Marston, Boston

Vice-Chairman—H. W. Griswold, Hartford

Sec'y.-Treas. — S. W. Ellsworth, Boston

Trustee—P. A. Shaw, Manchester, H. J. Cook, Auburn, Me.

# PURVEYOR HELD RESPONSIBLE FOR WATER QUALITY ON CUSTOMER'S PREMISES

## *A Case of Poisoning from Water Delivered Through Lead Service Pipe Owned by Consumer*

By E. SHERMAN CHASE*
BOSTON, MASS.

An English decision in 1938 and an American decision in 1939 only recently handed down, apparently establish the responsibility of water purveyors for the quality of water delivered through lead service pipes if such lead pipes are permitted and specific or common knowledge of danger of plumbo-solvency of the water is established.

In the English case it was established that the plaintiffs contracted lead poisoning from water supplied through lead service pipes from the mains of the Irwell Valley Water Board. The lower court found and the Court of Appeals affirmed the finding that the Water Board was negligent. It was held that it was the common law duty of the Water Board to warn the plaintiffs of the danger involved in the use of water through lead service pipe, or else to have taken steps to reduce the plumbo-solvency of the water. Judgment for the plaintiffs, amounting to about $4,000 were entered against the Water Board.

### *Recent Decision*

In the United States the Supreme Court of Massachusetts, in an opinion written by Judge Lummus found that the town of North Attleborough was responsible for the quality of water served through lead service pipes. This finding was made in the case of Horton vs. North Attleboro, which was heard by the Court on appeal by the plaintiff on exceptions to rulings of the trial judge.

In 1933, Horton applied to the town for a water service. The regulations of the water department permitted lead pipe and required approval of service pipe installations from the street to the house, by the water works superintendent. The plaintiff employed a plumber to install a three-quarter inch lead service pipe from the property line to the meter in his home, a distance of 145 feet, and the water department laid a similar pipe a distance of 27 ft. from the main to the property line at the shut-off gate. Water was supplied to the plantiff beginning in September, 1933. Subsequent to this time the plantiff's health began to fail and in July, 1934 his trouble was diagnosed as lead poisoning.

The evidence in the case showed that the poisoning was caused by the drinking water. Samples showed quantities of lead ranging form 1.5 p. p. m. to more than 8 p. p. m., depending upon the length of time of contact in the lead service pipe. The water delivered to the service contained more than 30 p. p. m. of carbon dioxide.

### *Water Board Unaware of Hazard*

The water board was apparently unaware of the hazard involved. Analyses of water supplied to other consumers had shown no excessive quantity of lead. It should be noted that only one other service in the town was of greater length than that of Horton.

The trial judge had ruled that the responsibility of the town for the quality of the water did not extend beyond the property line. He did rule, however, that there was an implied warranty of quality under the Massachusetts sales act, as regards the water as delivered to the property line. As there were no exceptions from either side, to this latter ruling, it became the law of the case, although Judge Lummus states in his opinion, without deciding on the question, that "the weight of authority is to the effect that that provision of the sales act does not apply to the furnishing of water through pipes." The opinion further reads, "If there is a warranty under the circumstances of this case, as the trial judge ruled, it is a warranty that when water becomes the property of the plaintiff it will be reasonably fit to conduct through one hundred and forty-five feet of lead pipe into the house and then to be drunk."

In the lower court the judge was asked by the plaintiff to rule that a town selling water is under a duty to take reasonable steps to disclose whether the water is fit for domestic use when delivered through the kind of pipes the town expects to be used. This request was denied. The Supreme Court, however, found the trial judge in error in this particular and Judge Lummus, in his opinion, states, "The defendant was bound to take into consideration the fact that the water could not be drunk at the water gate, and to adapt its care to the fact that its water had to pass through a leaden service pipe in the house before it would be or could be used for drinking."

### *Probably of Far Reaching Effect*

These two decisions are likely to have far-reaching effect and place squarely upon water departments and water companies the responsibility for harm to health resulting from the quality of the water delivered to consumers *at point of use.* Apparently, negligence must be shown and the criterion in this respect seems to be what, in the language of the Court, is the "then state of common knowledge of those versed in the subject." Whether these decisions can be applied when damages result from other than health injuries, remains to be seen.

*Partner, Metcalf & Eddy, Engineers

# NEW JERSEY SEWAGE WORKS ASS'N

## *Hears About "Frapped" Sludge and New Automatic Effluent Filter*

THE Annual Meeting of the New Jersey Sewage Works Association, held in Trenton, N. J. on March 7th and 8th, was the 24th staged by this pioneer organization of sewage works operators. (Next year, to commemorate its 25th birthday, a special program is being arranged.—Ed.)

### *Highlights*

Highlights on the technical program were the following.

John P. Downes, who every year or so springs something new, this year told of his proposal to dewater sludge by the "frappe route," involving a quick freeze and thaw of digested sludge thickened by the chemical floation scheme employed at the Plainfield plant for the past several years. It involves a most ingenious scheme of separation of the water as frost crystals, which upon thawing drains away promptly. What Downes says about the scheme, sounds intriguing.

Wm. C. Laughlin, of Laughlin Magnetite Filter fame, described his new shallow bed automatically cleaned down-flow filters for effluent straining and polishing. The filter bed consists of sand and is washed in a manner productive of maximum clarification and wash water economy.

Dr. W. Rudolfs, in his annual recounting of the work and findings of the N. J. Division of Water and Sewage Research, found his listeners as eager as ever.

Perhaps the highest "highlight" was the coming of the Governor of New Jersey—The Hon. Harry A. Moore—to present a genuinely interested commendation of members of preciated work that they were doing the Association for the too little appreciated work that they were doing in making New Jersey a better place to live.

#### *Officers Elected*

According to the custom of the Association, officers are elected for two year terms and the following are continued for 1939-'40:

President — Edw. P. Molitor, Springfield, N. J.; 1st Vice-Pres. Saml. R. Probasco, Burlington, N. J.;

*The President*
*Edw. P. Molitor*
*Sup't. of Sewerage*
*Springfield, N. J.*

*1st Vice Pres.*
*Sam'l. R. Probasco*
*Sup't. of Sewerage*
*Burlington, N. J.*

2nd Vice Pres.—Henry Van Der Vleit, Maywood, N. J.; Secretary—John R. Downes, Bound Brook, N. J.; Treasurer—Paul Molitor, Jr., Morristown, N. J.

### *Hazards in Sewerage Operations*

The forenoon of the first day was devoted to the matter of hazards and safety in connection with design and operation of sewage treatment works and sewerage systems.

The first speaker was the Chairman of the Committee on Gas Hazards of the American Gas Association, J. B. Klumpp, Philadelphia Consulting Engineer. Mr. Klumpp prefaced his discussion by remarking that, from what he had learned of operating conditions, it was surprising that sewage plants had escaped serious accidents as well as they have. Amongst his comments and recommendations were the following:

To prevent varying pressures, gas holders at treatment plants should be more adequate in capacity; gas lines should be not less than 3 in. in diameter; gas handling equipment should not be below ground level or, if so, ample forced ventilation provided. Mr. Klumpp felt that every plant should have one hand one of the simple to use M. S. A. Explosiometers for detecting danger spots. He demonstrated such an instrument along with the M. S. A. Hydrogen Sulphide Detector. He recommended wearing of rubber soled shoes in danger zones, and using modern non-sparking tools and motors.

Mr. Klumpp cited the fact that it was fortunate that explosions could take place in mixed air and sludge gas only when the mixture contained between 8½ and 18% gas.

#### *Report of the Joint Committee on Gas Hazards*

By E. F. Shissler, (Chairman) Supt. Sewerage, Haddon Heights, N. J.

This interesting report consisted of two parts—viz:

Part 1—"Recommendations to Managers and Operators of Sewage Works."

Part 2—"Recommended Principles for Safe Design of Plants and Equipment."

To managers and operators the following recommendations amongst others, were emphasized.

(1) More attention to sewer cleaning and flushing to preclude gas generation, odors and explosion hazard at manholes, pump sumps, screen chambers.

(2) More attention to adequate ventilation of pits, sumps, etc., and forced ventilation of under-ground rooms.

(3) Use of tell-tales and cut-off or cut-on switches to maintain more uniform conditions in sludge digesters and gas storage devices.

(4) Increased inspections of all liquid gas seals.

(5) Venting out of doors, of traps and secondary seals which may blow or leak inside of buildings. Preferably of the complete elimination of as many as possible.

(6) Checking to see that all electric motors are of the non-sparking type.

(7) Purging sumps, digesters and sewers by use of air-blowers before entry. Never depend upon cannister type masks in such places where oxygen deficiency is the real danger. Instead, employ an oxygen breathing or a hose type air mask.

(8) Store all chlorine cylinders not

in service in a fire-proof building or room.

Amongst equipment recommended are the following:

(1) Oxygen helmets and safety harness; (2) Fire extinguishers; (3) Equipment for detecting explosive atmospheres and hydrogen sulphide; (4) Manometers at valve locations to indicate gas line, gas holder and digester pressures.

Amongst *"Design Recommendations"* were the following:

(1) With fixed cover digesters, gas storage capacity of not less than 0.3 cu. ft./capita for crude sludge, and 0.5 cu. ft./capita for activated sludge digestion.

(2) Floating-cover tanks as well as fixed cover tanks to be connected to a gas holder. Digester walls and roof to be gas tight.

(3) Each floating cover, or digester gas-dome, to have safety pressure release to operate at 2 in. or more water pressure above the settling of any other release device in the system. But such device must not release at a pressure less than 8 inches.

(4) Gas pipe-lines to be of rust proof materials pitched at ¼ in. per 15 ft., run, to drip pots. Exposed lines to be insulated to prevent chokage by frost formation.

(5) Minimum size of main line gas pipes to be 3 in. and auxiliary lines 2 in.; insulation being assumed. To gas engines a separate line should run from gas storage.

(6) Flame traps to operate at 2 in. water head.

(7) All vents, drips, seals to be vented to the outside.

(8) Pressure relief devices designed to discharge at minimum of 6 inches water head, should be provided.

(9) Gages installed to show gas pressures in digestion tank and so located to be visible at points of control in drawing sludge or supernatant; also installed on lines before and after flame traps and other safety devices.

(10) Gas holders of the high pressure type should include a balancing suction tank and automatic regulators to the pump controls.

(11) Forced ventilation of all screening wells; non-sparking and corrosion proof motors.

(12) Flame traps, meters, pressure relief heaters, etc., should be located in a separate room or building with floor at or above ground level; doors and sash opening outwards and ventilated at floor and ceiling; approved electric wiring and non-sparking switches and motors of course.

(13) Waste gas lines to be valveless and to discharge well above roof levels and away from building.

(14) An interesting recommendation was that made against the use of individual small gas heaters for burning digester gas.

(Seemingly a highly important oversight occurred when no recommendation was made to insure proper drainage of waste gas lines back to a drip-pot and, most important, adequate protection of both against freezing and consequent chokage due to frost chilled out of the gas which is normally super-saturated when leaving the digesters. A hazard to equipment was apparently overlooked when nothing was said concerning the desirability of gas scrubbing to remove moisture, sulphides and other impurities.—Ed.)

*R. M. Cadman,* Engr., Scheduled Rating Office of New Jersey discussed construction requirements of his Bureau, such as 9 in. concrete footing walls, fire walls, etc. He stated that where gas handling equipment is not approved 25 cents penalty per $100. value is added to insurance premiums, indicating the economy of utilizing recognized and proven equipment now available from responsible manufacturers. Because of the record of sewage plant explosions, where gas is collected and utilized the rates had been boosted to 20 cents per $100, as against 6.8 cents for plants wasting gas.

Others to comment on the report were committee members I. R. Riker of Princeton and Leigh Morrow, of the N. J. Dept. of Health.

Unfortunately, open discussion of the hazards committee report was postponed. As a result, there was none. One question was asked—Are open electric heaters permissible in treatment plants? The anwser was pointedly—"NO".

### *First Aid Team Demonstrates*

A splendid demonstration of first aid methods, to apply to persons suffering electric shock, gas poisoning or asphyxiation, was put on by the medal winning team of the Public Service Company of New Jersey. The highly effective and practical Shafer Prone-Pressure Method of artificial respiration was demonstrated. For gas cases an inhalator providing a mixture of pure oxygen diluted with carbon dioxide in the ratio of 93 parts oxygen to 7 parts carbon-dioxide was highly recommended for sewage works.

*"Late Developments at the Plainfield Sewage Treatment Plant,"* by *John R. Downes,* Supt., Plainfield District Plant, Bound Brook, N. J.

Mr. Downes' brief review of what's new at the famed Plainfield Plant, revealed the interesting fact that out of the $450,000 invested in the plant over the 22 years of its existence not more than 3 per cent represented non-useful construction and equipment as the plant stood today. The current improvements involve addition of screenings comminutors, new dosing syphons for the 22 yr. old sprinkling filters, a final settling tank (80 ft. diam.) equipped with a magnetite filter.

From this final tank two 3600 g. p. m. Worthington pumps would provide recirculation to the filters at a continuous rate of 7 m. g. d. to effect high rate filtration. Two more digesters were being added to provide a capacity of 2 cu. ft. capacity per capita. Sludge with 7.5 per cent solids was being concentrated by chemical flotation to 16 per cent solids, the concentrate being evaporated in the spray drier and resultant dry material burned with powdered coal. Sale of the material as fertilizer had proved less profitable than burning.

Mr. Downes then described a new sludge dewatering scheme which has a highly interesting and novel aspect. Basically it involves quick freezing of the wet digested sludge which upon quick thawing rapidly releases its water draining through a screen. The process leaves a residue containing 30 per cent solids, with texture of friable clay. Mr. Downes analysed each step in the process. Power for refrigeration is to come from gas engines driving ice machines producing 7.8 tons of refrigeration per day to take away 2,268,000 B. T. U. per day and put back most of this heat in the thawing operation with the engine cooling water. (We are pleased to announce that Mr. Downes' intriguing "Frosted Sludge" story is to be published shortly in this magazine. Therefore, details are being omitted from this digest. —Ed.)

## *The Governor Appears*

Before this Sewage Works Association came New Jersey's new governor—A. Harry Moore—to say a few words of commendation on the good work being done by its members, and to state that he hoped that every man would join him in his desire to make streams clean and New Jersey a "Garden State". Then he swung to what he termed his pet project to strengthen the water supply of industrial New Jersey—the Delaware and Raritan Canal project, the details of which he left to his good friend, Charlie Capen to expound, while he rushed off to a legislative session. It was another instance of the interlocking of water works and sewerage which has been notably on the increase in recent times.

*"The Delaware & Raritan Canal Water Supply Project"* by *Chas. C. Capen,* Engr., North Jersey District Water Supply, East Orange, N. J.

Mr. Capen also emphasized the note-worthy trends which were dovetailing water supply and sewerage and presented the high lights of the proposed project introduced by the Governor. The old Delaware & Raritan shipping canal, connecting the two named rivers, came into full possession of New Jersey in 1934. The proposal is to convert the canal into a water supply aqueduct to supply the Elizabeth, New Brunswick and Plainfield area with 150 to 160 m. g. d. Delaware river water diverted above Trenton, purified at Bound Brook and lifted to storage for wholesale distribution to the several cities for retail distribution.

Mr. Capen touched on some of the technical considerations of the project to cost roughly $33,000,000 including filtration, pumping, a reservoir, 21.5 miles of 6 ft. conduit and 6000 ft. of tunnel.

**The Governor in Action.**

*The Hon. A. Harry Moore Commends the Work of the Association.*

**Wheel Horses**

*Paul Molitor, Jr., Sup't. Morristown, N. J. (Treas. and Ass't. Sec'y. of the Association) Edw. Schissler, Sup't. Haddon Hgts., N. J. (Chairman Hazards Comm.—a Past President) John R. Downes, Sup't., Plainfield, N. J. (Secretary and Editor—a Past President)*

*E. A. Bell, Boro Engr., Essex Fells, N. J. Joseph Strahan, Sup't. Sewerage, Asbury Park, N. J. Ralph L. Carr, Engr., Mathieson Alkali Works, New York City.*

*Wm. C. Laughlin, Consulting Engr., New York City. William Lafferty, Plant Sup't., Lakeland, N. J. John D. Woodward, Sup't., Conshohochen, Pa.*

*"INCODEL" — Its Accomplishments*—by *James H. Allen,* Chief Engr., "Incodel", Philadelphia, Pa.

Mr. Allen set forth progress being made by "Incodel", set up as a non-legalized agency to make of the Delaware a cleaner stream, through education, cooperation and joint state zone efforts. The river, then he outlined, has been divided into four zones, with sewage purification requirements set for each zone.

In examining the accomplishment record for the past year, 18 communities had entered into contract to provide sewage treatment in the Camden area to give 100 per cent sewage treatment in Delaware Co. New Jersey. Philadelphia, pushed by Penna. Sanitary Water Board, had set up the Philadelphia Sewerage Authority to finance a $40,000,000 treatment project through P. W. A. aid and revenue bonds.

*"The Advantages of Inter State Action to Abate Pollution",* by *Seth G. Hess,* Chief Engr., Interstate Sanitation Commission, New York, N. Y.

Mr. Hess outlined the functions of the Interstate Sanitary Commission (N. Y. and N. J.) as—

(1) Establishment of standards and classification of interstate waters, based on probable use.

(2) Actions against offending communities.

(3) Checking any and all conditions affecting pollution of interstate waters.

## *Studies and Research*

*"Notes on Experimental Work"* by *Dr. W. Rudolfs,* Chief, N. J. Div. of Water and Sewage Research, New Brunswick, N. J.

As in past years, the report by Dr. Rudolfs recounting results of experimentation and the year's investigations by the staff of the N. J. Div. of Water and Sewage Research, constituted a high-light of the program.

(1) *Activated Sludge Studies*—disclosed that rates and degree of absorption and absorption by activated sludge is dependent upon biological phenomena. In healthy active sludges such absorption is essentially completed during the first hour of sewage-sludge contact in aeration units, the balance of the aeration period being required in re-conditioning and re-activation of the "loaded" sludge flocs. As to the role of enzyme activity; Results indicated that volume of sludge played the greater role in effective clarification than degree of enzyme activity. With increasing periods of aeration the activity of pepsin (albumin splitter) increased pronouncedly, whereas that of diastase (starch splitter) and lipase (fat splitter) were essentially unchanged. Raising pH values of mixed liquor above pH 7 increased activity of pepsin and diastase, but trypsin and lipase were not affected.

(2) *Chemical Precipitation Studies*—revealed that pre-settling of sewage is neither helpful nor detrimental to coagulation or coagulant economy. In fact, coagulation of non-settled sewage seemed to prove the more economical scheme. In general, optimum pH values in coagulation appeared to be at pH 4 on the acid side and at pH 9.5 on the alkaline side.

(1) *Geo. H. Peary, Plant Sup't., Bogota, N. J.; B. McLaughlin, Sup't., Westwood, N. J.; G. J. Fredericks, Sup't., Ridgefield, N. J. (Messrs. Fredricks and McLaughlin are President and Treasurer respectively of the Bergen County Operators Assn.)*

(2) *Leslie E. West, Chief Engr., Sewerage District of Elizabeth, N. J.; Seaver Jones, Sales Mgr., T. A. Gillespie Co., New York; Elson T. Killam, Consulting Engr., New York City.*

(3) *W. B. Denise, Chief Operator and his boss W. J. Schivera, Boro Engr., Freehold, N. J.;* (4) *Leigh Morrow, Engr., State Dept. Health; Jack Boardman, Consulting Engr., Philadelphia, Pa.; J. P. Cloud, Chairman, Sewage Commission, Woodbury, N. J.*

While high speed initial mixing proved of considerable importance the addition of inert pulverant materials, to serve as floc aids, proved of little merit in reducing coagulant requirements. Likewise, return of chemical sludge to crude sewage proved but little worth as an economy practice. Flocculation periods of not under 15 minutes should be employed. On the whole, air diffusion for floc formation was less effective in subsequent settling than mechanical paddle flocculation at diminishing speeds. The settleable solids in sewage played little or no part in increasing the demand of iron coagulant, the latter being a function of the soluble solids. The ammonia concentration proved an index to iron-demand. The ferric iron added is absorbed by soluble organic bodies without floc formation until the whole of the iron demand is satisfied and optimum pH value is approached.

(3) *Fertility Values of Sludges*— when studied, reveals greater plant growth promotion than chemical analyses indicate possible. In recent years attention has been focused on growth promoting substances closely identified with those present in sewage sludges. A study of the efficacy of sludges in respect to such values, and how to improve them through modified sludge digestion or processing, is under way.

Dr. Rudolfs mentioned the continuation of stream studies to determine the effectiveness of treatment plants recently built and the growing industrial pollution load. Also, work is under way to render more dependable the existing methods of sewage and sludge analyses. Another new study of consequence is that looking to the effect of greases and oils on the behavior of sewage treatment processes. Plant performance seemed definitely related to grease content of sewages.

*"Suspended Solids Removal from Sewage and Wastes by Filtration"* by *Wm. C. Laughlin*, Filtration Engineer, New York, N. Y.

Mr. Laughlin, who developed the novel Laughlin Magnetite Filter which was first used at the Dearborn, Mich. Sewage Treatment Plant, and several important plants since, outlined some of the advantages from effluent filtration (straining) and results attained from representative installations of these shallow bed Magnetite Filters. The principal advantage was the production of more uniform quality and better appearing effluents, under variable operating conditions and settling efficiencies, regardless of the type of treatment involved. In addition, an economic advantage lay in the need for shorter sedimentation periods in smaller tanks, savings in chemicals in precipitation, if not also air in the activated sludge process.

Mr. Laughlin then described a new type of shallow bed self-cleaning automatic filter, his most recent development. The new small scale filter, now in service for some months at the Atlantic City, N. J. Treatment Plant, was described and pictured. It makes use of downflow fiiltration through a 6 inch bed of sand supported on a slotted plate bottom. The bed is washed by a travelling cleaner which is designed to clean only the surface on two traverses of the bed, while on each third and fourth traverse the whole depth of 6 inches is lifted and washed automatically when head loss reaches a predetermined point.

The top washing unit consists of a cutting (skimming) blade which lifts the top ½ in. of sand into the scrubbing chamber where a stirring paddle and pumped effluent performs the scrubbing. The bottom cleaner consists of perforated tubes which run beneath the bed parallel to and above the slotted bottom. Effluent under pumped pressure is used in this washing and the dirty water is returned to the crude sewage by a low head pump on the travelling mechanism. For increased scrubbing effects air is bled into the suction of the pressure-wash pump. Rates of wash involve about 1 gal./min./sq. ft. for surface washing and 8 to 10 times that rate for the intermittent wash of the whole bed. The whole of the wash liquor

(1) *John Nelling, Asst. Supt., Glassboro, N. J. and Joseph E. Haines, Sup't., Mt. Ephrairn, N. J.*

(2) *G. L. Walton*, Sup't., Glassboro, N. J. and Leroy H. Graul, Sup't., Wildwood, N. J.; (*Mr. Walton is President of the South Jersey Sewage Works Ass'n.)*

(3) *J. B. Roberts, Engr., Chain Belt Co., of Milwaukee and J. K. Adams, Sup't., Tenafly, N. J.*

(4) *Jack W. Collum, Sup't., Bordentown, N. J. and Harry C. Greenfield, Ass't. Engr., N. J. Dep't. of Health.*

requirement has amounted to roughly 5% of the sewage flow, representing that much of the effluent recirculated in the washing operation when handling Atlantic City settled sewage carrying suspended solids of 58 to 112 parts per million.

Mr. Laughlin cited some representative operating results showing suspended solids removals of from 20 to 61 p. p. m. and B. O. D. removals of 32 to 81 parts by the 6 inch bed of sand of 0.44 mm. effective size and uniformity coeffient of (2) two. Grease removed ran from 6 to 28 parts per million.

Mr. Laughlin stated that with his new down-flow sand unit 6 to 9 in. head gave best overall filtering efficiencies which could be maintained by the automatic wash control. Based on the Atlantic City tests and demonstration at rate of 200,000 g. p. d., filters to handle 3 m. g. d. of an industrial waste were now being designed.

**Eric Hartmann, Inertol Co., New York City; M. B. Tark, Link Belt Co., Philadelphia; Maurice Brunstein, Chemist, Atlantic City.**

*"Sludge Digestion and Methane Bacteria"* by *H. Heukelekian,* Bacterialogist, N. J. Water and Sewage Research Div., New Brunswick, N. J.

Dr. Heukelekian presented results of sludge digestion studies which so far justify the conclusion that opitmum pH value for maximum methane production is pH 7.—(exactly neutral)—with bio-activity tapering rapidly on either side of pH 7.0. Temperature is 28 to 35 deg. Centigrade proved opitmum.

*"Operation of the Lakeland Chemical Treatment Plant" by Wm. Lafferty,* Plant Supt., Lakeland, N. J.

Describing the operation of the Lakeland plant, which employs chemical precipitation and effluent filtration. Mr. Lafferty reported consistent results with 69 lbs. of ferric chloride and 263 lbs. of lime for an average flow of 381,000 gals.

*"Industrial Waste Treatment"*—by *Ralph L. Carr,* Technical Service Engr., Mathieson Alkali Works, New York City.

Mr. Carr's paper constituted a noteworthy and painstaking review of the literature covering industrial waste treatment, with a full list of references to 57 original articles. The paper in itself is a digest and and therefore not subject to condensation for this report.

The following manufacturers took exhibit space:

American Brass Co., Waterbury, Conn.

Ralph B. Carter, New York City.

Chain Belt Co., Milwaukee, Wis.

Chicago Pump Co., Chicago, Ill.

Dorr Co., New York City.

Eimer & Amend, New York City.

Fairbanks, Morse & Co., New York City.

Flexible Sewer-Rod Equp. Co., Irvington, N. J.

Hardinge Co., York, Pa.

Homelite Corp., N. Arlington, N. J.

Inertol Co. Inc., New York City.

Johns-Mansville, New York City.

Kingston Trap Co., Kingston, N. J.

Link Belt Co., Philadelphia, Pa.

Municipal Sanitation, New York City.

Penna. Salt Mfg. Co., Philadelphia, Pa.

%Proportioneers, Inc.%, Providence, R. I.

Signal Eng. & Mfg. Co., New York City.

Arthur H. Thomas Co., Philadelphia, Pa.

Trohn's Supplies, Inc., Mamaroneck, N. Y.

Wailes, Dove-Hermiston Corp., New York City .

Wallace & Tiernan Co., Newark, N. J.

Water Works & Sewerage, New York City.

## "SEWER RENTALS"
## A New A.P.W.A. Publication

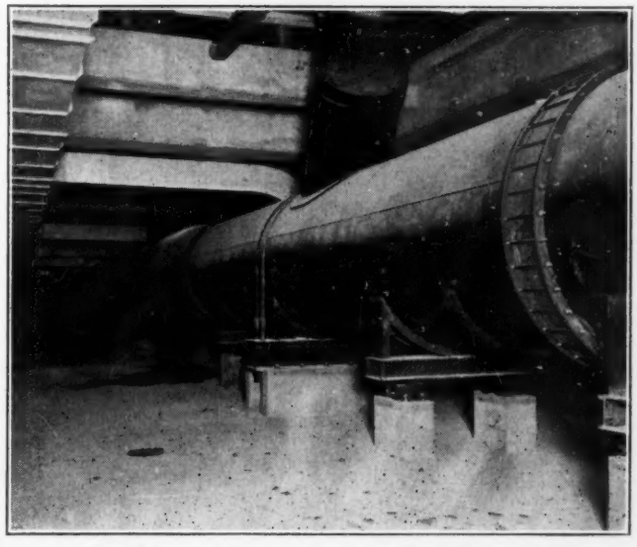
Just published is the 120 page brochure on "Sewer Rentals" which is a production of the American Public Works Association. In it is presented for the first time a detailed analysis of administrative practices employed when sewerage or sewage treatment acilities are financed on a service charge basis. The study which made this document available was undertaken by A.P.W.A. in cooperation with the Municipal Finance Officers Association.

"Sewer Rentals" contains a compilation of sewer service financing practices in more than 100 American cities, with a full discussion of methods and procedures employed. In addition to text, it contains 75 pages of tables of ready reference material covering methods, practices, and results in these cities.

Amongst topics discussed in the brochure are: rate structures; bases of charges; rates; billing and collecting practice; delinquencies; special rate and adjustment problems; disposition of revenues.

"Sewer Rentals" is an 8½ x 11 inch mimeographed volume of 120 pages—paper bound. It may be purchased at $1.50 per copy from the American Public Works Association, 1313 East 60th Street, Chicago, Illinois.

## "BIG BUSINESS"



*An 84 in. Main Required for the Air Supply at the World's Largest Sewage Plant—Chicago's Southwest Activated Sludge Plant, designed for 400 M.G.D. average flow.*

*(Note the adaptation of Dresser type flexible couplings, which serve also as expansion joints. Also note the cradles on rollers to permit expansion and contraction creep between joints.)*

## The Editor's Comments

# WATER QUALITY TAKES ON NEW MEANING

A decision recently handed down by the Massachusetts Supreme Court bids fair to prove of greater and more wide spread importance in public wate supply practice and policies than any court opinion in years.

Because of the far greater number of water works operators and executives who will ultimately feel the effect, this decision may prove to outrank in importance the decisions of the U. S. Supreme Court which only a few years ago upset the age old common-law of riparian rights and established the law of "equitable use." Thereby appropriation and diversion of stream waters from their natural courses to another watershed for public supply is legallized as a taking for the "highest use."

The opinions and decisions of the Massachusetts Court were listened to with keen interest by members of the New England Water Works Association last month. To many the great importance was the precedent established and the setting up of a new law, defining and fixing the responsibility of purveyors of public water supply in respect to its chemical and physical qualities. An informal recounting of the gist of the opinions of the Court by E. Sherman Chase has been put in form for publication, at our request. His review appears elsewhere in this issue, along with a digest of questions which were raised and speculatively answered during the meeting.

The most important aspect of the decision seems to be that of responsibility of purveyors for water quality beyond the point of delivery onto the premises of the water taker, thus disallowing the claim of the purveyor—(in this case a municipal water board)—that it could not be held responsible or liable for the quality of the water once it had passed beyond the city owned pipes and into the pipes of the customer. That is to say, the city authorities disclaimed all control over, and responsibility for, quality of the water beyond the curb-cock connecting the street service-line with the customer-owned service line. In this instance the Water Board of North Attleboro was held liable for injury to the health of the customer and his family because the quality of the water, although safe for human consumption when leaving the public mains, became unfit on the customers premises. The reason, therefor, was its ability to attack and dissolve the material of which the customers service pipe was made, which it did. The service pipe was of lead (as was the city owned service) and lead poisoning resulted.

As pointed out in the discussion following the reading of the opinion, the chief weapon of the legal fraternity in bringing damage suits is the finding of "precedent" and citing case history and actions taken in recorded cases. With such now available, in the form of the Massachusetts decision, the way has been fairly well paved for lawyers who may find it expedient financially or politically to encourage individuals or tax-payer groups to bring suit against water companies or water departments when the claims for damage may appear to have a parallel in the Massachusetts case. And, it is pertinent that an English decision of about a year previous, holding a Water Board liable for supplying to the consumer a water proven aggressive to lead, was cited as a "precedent". Therein, the Court had rendered an opinion to the effect that it seemed clear that it was the "common-law duty" of the purveyor of water to the public to provide a water that was not dangerously *plumbo solvent.*

Seemingly the specific reason for holding the purveyors liable in both of these cases were the established scientific facts which should have been known to the purveyor concerning the *plumbo-solvency* of waters of the quality served, plus the existing knowledge concerning methods of treatment for its correction: Failure to recognize *plumbo-solvency,* or to install proper treatment, or to warn those known to have lead service pipe, constituted proof of negligence on the part of the purveyors.

Only a few months ago did Oklahoma City's Municipal Councellor, A. L. Jeffrey, in addressing the Southwest Section A.W.W.A. on "The Extent of Municipal Liability", point out that to recover damages in suits against municipalities it was merely necesary to prove that negligence had been *contributory* in the damages suffered.

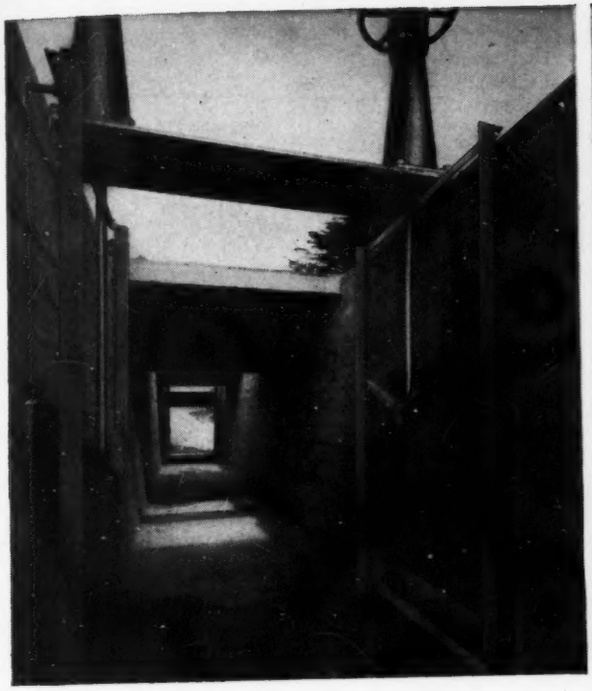
Interesting (possibly significant) is the fact that concurrently with the rendering of the Massachusetts decision the water-department of an important Southern city was being faced with an organized effort of consumers to prove claims for damages suffered due to water quality resulting from lack of effective treatment. In this instance damage to heating units and failures of equipment in household hot-water systems was claimed. And, although the Massachusetts case was decided on the score of damage to public health, and only incidentally to attack on the consumers' pipes, the other case cited constitutes an indication of what may prove the next stage in holding water utilities responsible for water quality.

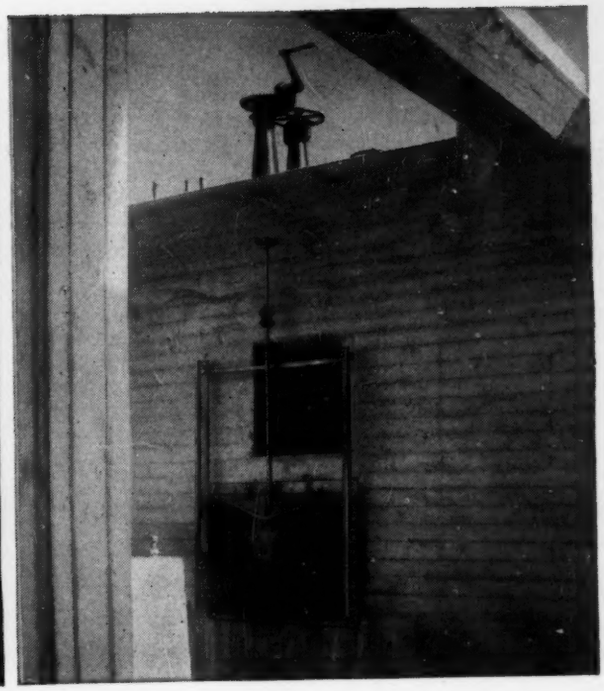
It is trite to remark that the consuming public has become more water quality conscious in recent years; or, that the day of the purveyor "praying" for improvement, when consumer complaints begin to pour in, and assurance from the authorities that the water is "safe notwithstanding its temporary unpalatability", due to this or that reason, have begun to tire the public patience. We doubt that the public is nearly as interested in the economics of water supply practices (cost of production) as it is in a pleasant-appearing, good-tasting, easy-lathering, non-destructive and non-poisonous product delivered at its faucets. The hand-writing on the wall, further emphasized by the recent decision, spells increasing responsibility for water works operators and officials; and with it, we hope, increased recognition professionally and financially.

In this issue the lead article tells the story of a water department manager who for years has a record of keeping a jump ahead of public demand—his latest contribution to the community being "soft-water the year round at no added cost". How he has accomplished what the business-minded public likes to read about in his home-town papers, we leave to be told by Scotland G. Highland, manager of the politically unencumbered and envied Water Board of Clarksburg, W. Va.

# EVERDUR ... Strong, Corrosion-resisting,

## *installed in San Francisco's Richmond-Sunset Plant*





Photographs show three of the nine gates recently installed in the Richmond-Sunset Sewage Treatment Plant of the City and County of San Francisco, Calif. Dimensions vary, one is 36″ x 48″, four are 36″ x 36″ and four others 24″ x 24″. The gate bodies are Everdur castings, the lifting stems were made of 1½″ Everdur rod, the guides from brake-formed Everdur angles. All reinforcement cross bars, as well as all nuts, bolts, washers, etc., are Everdur. Equipment fabricated and installed by the California Corrugated Culvert Co.

FOR more than ten years, Everdur has been employed with outstanding success in the sewage treatment, reservoir and water works fields. Throughout this service it has shown uniformly excellent resistance to corrosion under a wide variety of severe operating conditions.

This Anaconda Copper-Silicon Alloy is economical to use, for it is readily workable either hot or cold, and can be welded by any of the commonly used methods. The exceptional strength of Everdur Metal, and its availability in all commercial shapes, make possible many fabricating economies—and the use of light weight wrought shapes for built-up structures. Experienced Service Engineers of The American Brass Company are available at all times for consultation on the selection and fabrication of metals for sewage and water works service. Anaconda Publication E-11 gives detailed information about Everdur Metal in this field. Write for a copy. 38224

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# MORE PROGRESS

"WATER WORKS AND SEWERAGE is the ONLY magazine serving the Waterworks and Sewerage Fields that can boast a GAIN* in advertising volume for the first quarter of 1939 over the same period of 1938".

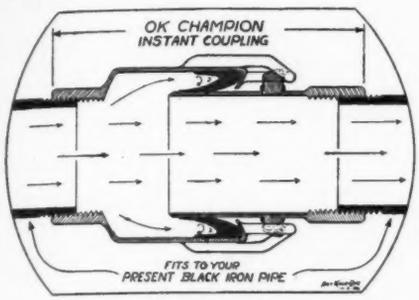
●

*( * 12.3 Per Cent)*

# EQUIPMENT NEWS

## "Water Water Anywhere!" with Champion Portable Pipe

Recently we saw "what every contractor and builder should have"—a pipe line that can be transported by one man, laid by one man, jointed by one man. It was a temporary pipe line of light weight galvanized pipes with Champion Corporation's flexible cup rubber-sealed Instant Couplings. In a demonstration the joints were made about as easily and as fast as it takes to say it.




**The Slip Joint**

A 16 ft. length of the galvanized 4 inch pipe weighs only 40 pounds when picked up at center was easily carried and laid by a light weight man. The 6 in. size weighs only 20 lbs. more per length. The O.K. Champion Instant Couplings went together with a ⅛th turn of the pipe length added and the temporary line was completed. For the fun of it, the writer, himself, tried laying a 2 inch line.

The joint's the thing. It can be used on any sort of standard threaded end pipe or hose coupling. The lugs turn into the eyes and lock. The interesting rubber cup-gasket becomes self-sealing when the pressure is turned on, and is leak proof up to 100 lbs. pressure—possibly more. While this pipe is chiefly sold for use as surface irrigation lines, it should find a variety of uses in laying temporary and emergency water lines or sewers.

For descriptive literature, write O. K. Champion Corp., Hammond, Ind.

## New Paving Breaker

A new "'Cushioned-Air" paving breaker known as the CC-80 has just been announced by Ingersoll-Rand.

The air-cushioned piston on this 80 pound breaker results in an easier holding hammer, especially at higher air pressures. Because there is less shock on the wearing parts, and because the piston cannot strike the front-head, there is less breakage and less upkeep.

Other design features include a larger anvil-block bearing which insures correct alignment, an extra large built-in lubricator, and other features. Form 2530 contains complete information. For a copy write Ingersoll-Rand Co., 11 Broadway, New York City.

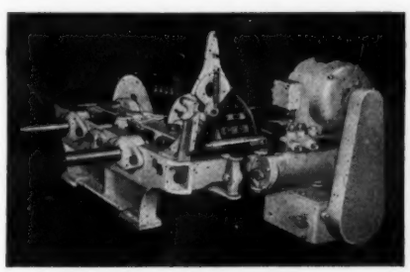
## New Reeves Hydraulic Automatic Control

● Reeves Pulley Co., Columbus, Indiana, announces a new and improved type of hydraulic automatic control for use with the Reeves Variable Speed Transmission.

With the Reeves Transmission, as a basis, this control provides entirely automatic speed regulation to make possible the synchronization of different machines, or equipment, such as sludge feed and vacuum filter speed.

The control is simple and compact in design, with few working parts. From 6 to 20 seconds are required to shift the Transmission from maximum to minimum speed, and vice versa, depending on size and ratio.

As shown in cut, the control is mounted at one end of the Transmission frame. A self-contained hydraulic power plant, mounted on the right hand set of shifting levers on the Transmission consists of a small electric motor operating an oil pump to supply hydraulic power.



**New Reeves Control**

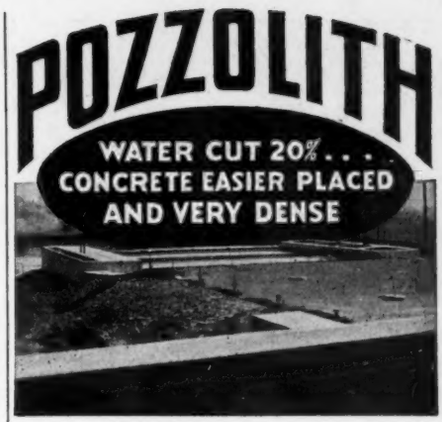
A two-way valve is mounted integral with a cylinder. A piston connects to the left hand set of shifting levers, while the cylinder connects to the right hand set. This combination, together with motor and oil pumps, offers the source of power for speed regulation. The valve directs flow of oil to either right or left hand side of the piston, thus operating it in either direction to increase or decrease Transmission speeds.

The valve is actuated by a rod which connects with the driven machine from which indication of required speeds can be taken.

For literature giving a description, beyond which space here permits, write Reeves Pulley Co., Columbus, Indiana.

## West Virginia Pulp and Paper in New Quarters

The Industrial Chemical Sales Division West Virginia Plup & Paper Company, Chicago, announces removal of their offices from 205 West Wacker Drive to 35 East Wacker Drive, effective April 15, 1939. This gives them larger and better office facilities, and they cordially invite out-of-town friends to use their offices as headquarters when in Chicago.

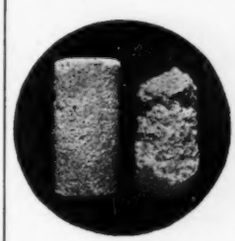

● There is no guesswork regarding the value of Pozzolith. Interesting facts regarding Pozzolith's ability to build more durable, watertight concrete are contained in letters from all parts of the country.

H. B. Olney, Inc., Contractors and Engineers, of East Chicago, Indiana, reports as follows: "We were very pleased with the results obtained from use of Pozzolith in the construction of the East Chicago Waterworks Filteration Tank last year.

"We used slag concrete on this work, and by using Pozzolith, were able to reduce the water content of the mixture 20%. We also found easier placement of concrete, which meant a saving in labor and, finally, the concrete so placed was very dense and watertight."

Other letters, telling of the many important features of Pozzolith are available on request. Send for them.

**PROOF OF EXTRA DURABILITY**



Pozzolith concrete is durable concrete! 200 cycles of freezing and thawing prove the greater durability imparted to concrete by Pozzolith. Pozzolith concrete lost only 2% in weight . . . plain concrete lost 22.9%!

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***Makes Joints that STAY Tight***

Tegul-MINERALEAD is clean and easy to handle and work. Those 10 lb. ingots don't mind rain or flood. No skilled labor needed. No delays when pot needs replenishing. ● Initial leakage heals almost at once, facilitating backfilling and tidying up of premises ● And joints are permanently tight under any vibration conditions ● Tegul-MINERALEAD has plenty of what you'll find in no other Bell and Spigot Jointing Compound. Write The ATLAS MINERAL Products Co. of Penna., Mertztown, Pa.

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**Simple to Use • Low in Cost**

**IN SLUDGE CONDITIONING — Better Performance at reduced cost, including that of dewatering equipment. Boosts filtration rate.**

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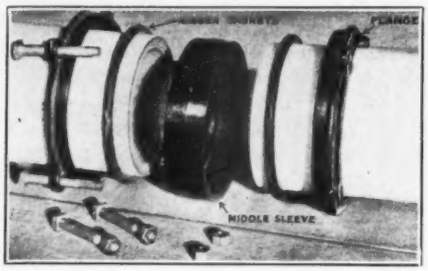
## "Duralite"

Asbestos Cement Pipes, Inc., announce "Duralite" as a newcomer in the pipe field. The name indicates its principal points of interest and merit—viz: durability and light weight.




**A New Asbestos Cement Pipe**

It is made of asbestos reinforced silica-cement mortar, built up on a revolving mandrel from hundreds of yards of a continuous thin sheet of asbestos-cement "felt," produced after the fashion of felt cloth, manufacture. The "bolt" accumulating on the mandrel is subjected to continuous and extreme bonding pressure for high density. Then follows curing to ultimate toughness and high skin resistance, to foist corrosion and reduce friction to a minimum.

"Duralite" pipes are produced in sizes 2 to 24 inch and are jointed with "Duralite" Flexible Couplings (pictured above), which form a joint locking seal of compressed rubber gasket rings. Amongst claims for this type coupling are the following. It can be applied in a muddy or wet trench with nothing more than two hands and a ratchet wrench. Because of non-necessity of pipe alignment to exactness, can be made up under water or even in the dark, if need be.

For a copy of "Duralite" write Asbestos Cement Pipes, Inc., 225 Broadway, New York, N. Y.

## Slip Joints of G-K Compound

Atlas Mineral Products Company of Mertztown, Pa., are now offering special forms for making Precast Slip Joints of G.-K. Compound for sewer pipes. These are especially designed for wet trench, where joint pouring with molten G.-K. Compound is difficult or unsatisfactory.

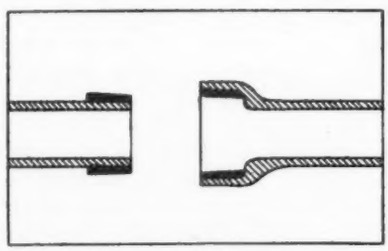


**Diagram of G-K Joint**

To make as many G.-K. Precast Slip Joints as may be required, the new joint may be poured at the trench side or in the yard. Mould rings supplied by Atlas make possible pouring of the bell ring and the spigot collar at one operation The pipe is ready two minutes later to go into the ditch, or to yard stock.

The assembly operation consists merely of painting the bell and spigot rings with G.-K. Adhesive, insertion of the spigot end and pushing it home. Bonding of the G.-K. surfaces flexible watertightness ensues.

***You can't get rid of SLIMY SAM SEWER SLUDGE with a shovel—***

You gotta have an OK Champion Sewer Cleaner to clean out your sewer mains.

The hand models will get him positively, but the power machines will do it faster. You don't want to send men down to spend all day in the sewer when it isn't necessary. You can't endanger the health of your citizens by dirty sewers when the remedy is so easy. Your expensive sewage disposal plant can't do its best work when sewers are dirty and costly damage to the plant happens regularly with dirty sewers.

Many years of rains washing down street dirt, cinders, bricks, etc., eventually fill up any sewer. Finally comes the day of flooded basements, damage suits and hurry-up, unsatisfactory, emergency, temporary cleaning.

New York City, Atlantic City, Flint, Little Rock, Bay City, Duluth, Westfield, Jersey City, Akron, Midland, Gary and hundreds of other cities keep their sewers at full efficiency by routine machine cleaning with OK Champion Equipment. The cost is very low.

**Why not get your copy of Champion literature, now ready for you?**

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## "Colormix"

As the name implies, "Colormix" mixes color *into* concrete or cement mortars. A new product, perfected by Master Builders of Cleveland, it is a finely ground powder of intense dyeing power for mixing into cement mortar to produce color *all the way through*. In addition "Colormix" contains Master Builders' "Omicron," a unique water-reducing agent which assures much higher strength, minimum porosity, and freedom from shrinkage, cracking, all of which make for better and durable floors.

To "Colormix" floors, promptly after hardening, is applied the effectively penetrating "Kuro-Krome" (Color-Cure) to provide an air tight seal which holds moisture in and prevent exuding of salts, to mar the surface. Likewise the "Kuro-Krome" finishing process provides a smooth but non-slip floor surface.

Interestingly, the "Colormix-Kuro Krome" floor does not have to be waxed for luster. It is kept in condition merely by washing. There is no paint to chip or wear away and Master Builders dub Colormix Floors — "permanent floors." There are 11 colors available.

# WITH THE MANUFACTURERS

## Joe Egolf, Jr. Appointed Ludlow's Pittsburgh Manager

*J. A. Egolf, Jr.*

● Ludlow Valve Co. of Troy, N. Y., announces the appointment of Mr. J. H. Egolf, Jr., as Manager of the Pittsburgh Distict Office of the Company.

Mr. Egolf, who for some time has been connected with the Ludlow's Pittsburgh office takes over the position held for the past 25 years by J. L. Madden, deceased.

Mr. Madden died as the result of injuries received in a fall from his hotel room window in Charleston, W. Va. Indications were that he was attempting an escape from a fire started in his room by a lighted cigarette which ignited the bedding.

## Parker Made Vice President of Pittsburgh Meter

*Walter Parker*
*Vice-President,*
*Equitable Meter Co.*
*Pittsburgh*

Pittsburgh Equitable Meter Company, announces the election of Walter H. Parker as Vice-President of the company. Mr. Parker has been Manager of the Liquid Meter Division for a number of years. In his new capacity he will have charge of all manufacturing operations in the two Pittsburgh plants as well as the factory in Hopewell, N. J.

This announcement was made recently by Col. W. F. Rockwell, president of the company.

## Chamberlain Becomes Crane Manager

L. H. Chamberlain

● L. H. Chamberlain, Los Angeles manager for Water Works Supply Company, since 1926, has been appointed manager of the water works sales section of Crane Co., Chicago, according to announcement by P. R. Mork, vice president in charge of sales.

A native of California, Mr. Chamberlain took courses in mechanical engineering at the University of California, leaving to serve in France as signal officer with the American Expeditionary Forces. He is a member of the American Society of Mechanical Engineers, of the American Water Works Association and is a registered civil engineer in the State of California.

W. A. Dallach, with many years of experience in Crane Co.'s engineering and sales divisions, becomes Assistant Manager of Water Works Sales. Like Mr. Chamberlain, Mr. Dallach is also well known in the water and sewerage fields.

## Krajewski-Pesant Acquire Valve and Sluice Gate Business of Coldwell-Wilcox Co.

It has recently been announced that the sluice-gate and valve business of the long established Coldwell-Wilcox Company of Newburgh, N. Y. has been acquired by the Krajewski-Pesant Mfg. Corp of New York City, well known designers and builders of sewerage equipment.

The Coldwell Wilcox Co. has for many years been designers and builders of water works and sewerage valves and gates and Mr. Frank G. Eldridge, former designing engineer for that company, has been placed in charge of the newly created Coldwell-Wilcox Division of Krajewski-Pesant.
ant.

With the addition of Coldwell-Wilcox valves, sluice gates and allied equipment Krajewski-Pesant are in position to supply requirements of municipalities and contractors more effectively than ever before.

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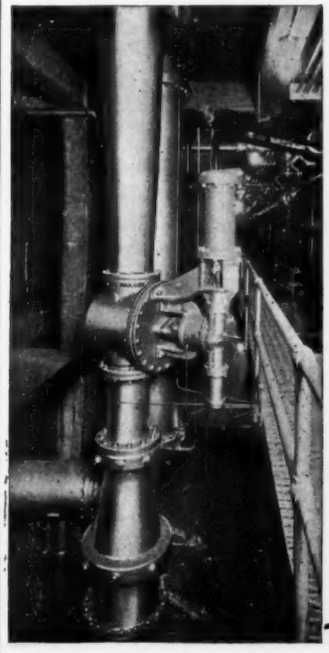

**The primary element for your metering application should be selected not arbitrarily but by the requirements to be fulfilled and by the economic considerations entering into the installation.**

**Sewage and sludge are often, though not always, measured by Venturi Tubes, Flumes, or Weirs.**

**Water may be satisfactorily measured by any type of primary element. Factors such as the cost of pumping, the pressure and the size of pipe or channel usually dictate the device used.**

**Steam is usually measured by the Bailey Orifice or Flow Nozzle.**

**Bailey Meter Company holds no brief for any particular primary element, its only interest is in making sure that the user secures the highest accuracy and reliability at the lowest expense.**

***Detailed information on the advantages of various types of primary elements furnished on request.***

MU-18

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## MEETINGS SCHEDULED

Apr. 17-19—SPARTANBURG, S. C. (Cleveland Hotel)
**Southeastern Section, A.W.W.A.** Sec'y-Treas., B. P. Rice, State Board of Health, 422 State Office Bldg., Columbia, S. C.

Apr. 20-22—URBANA, ILL. (Urbana-Lincoln Hotel)
**Illinois Section, A.W.W.A.** Sec'y, C. W. Klassen, State Dept. of Health, Springfield, Ill.

Apr. 21—SALEM, N. J.
**South Jersey Association Water Superintendents.** Sec'y-Treas., Walter Spencer, Merchantville, N. J.

Apr. 25-26—INDIANAPOLIS, IND. (Antlers Hotel)
**Indiana Section, A.W.W.A.** Sec'y-Treas., J. A. Bruhn, Indianapolis Water Company, 113 Monument Circle, Indianapolis, Ind.

Apr. 27—WILLIMANTIC AND STORRS, CONN.
**New England Water Works Association.** Secretary, Frank J. Gifford, 613 Statler Bldg., Boston, Mass.

Apr. 27-28—DAYTON, OHIO (Van Cleve Hotel)
**Ohio Section A.W.W.A.** Sec'y-Treas., T. R. Lathrop, State Dept. of Health, Columbus, Ohio.

May 3-6—COLUMBIA, S. C. (University of South Carolina)
**South Carolina Short School.** Sec'y, B. P. Rice, State San. Engr., 422 State Office Bldg., Columbia, S. C.

May 4-5—CUMBERLAND, MD. (Fort Cumberland Hotel)
**Maryland-Delaware Water & Sewerage Association.** Sec'y-Treas., A. W. Blohm, State Dept. of Health, 2511 N. Charles St., Baltimore, Md.

May 4-6—MIAMI, FLA. (Alcazar Hotel)
**Florida Section A.W.W.A.** Sec'y. J. R. Hoy. W. & T. Co., Hildebrandt Bldg., Jacksonville, Fla.

May 5-6—PHOENIX, ARIZ. (Hotel Adams)
**Arizona Sewage & Water Works Association.** Sec'y-Treas., P. E. Mauzey, City Hall, Phoenix, Ariz.

May 11-13—TACOMA, WASH. (Hotel Winthrop) (Tentative)
**Pacific Northwest Section, A.W.W.A.** Sec'y-Treas., Fred Merryfield, Assoc. Prof. San. Eng., Oregon State College, Corvallis, Oregon.

May 15—WEST SPRINGFIELD, MASS. (Springfield Country Club)
**New England Sewage Works Association.** (Spring Meeting). Sec'y-Treas., L. W. Van Kleeck, State Department Health, Hartford, Conn.

June 5-9—RALEIGH, N. C. (N. C. State College)
**North Carolina Water Works School.** D. S. Abell, Prin. Ass't. Engr., State Board of Health, Raleigh, N. C.

June 11-15—ATLANTIC CITY, N. J. (Hotels Ambassador and Chelsea—Meetings and Exhibits in Auditorium)

**American Water Works Association.** (59th Annual Convention.) Executive Sec'y. Harry E. Jordan, 22 East 40th St., New York City.

June 26-28—STATE COLLEGE, PA. (Nittany Lion Inn and Dormitories.)
**Pennsylvania Sewage Works Ass'n.** Sec'y-Treas., L. D. Matter, Distr. Eng'r., Kirby Health Center, Wilkes-Barre, Pa.

June 28-30—STATE COLLEGE, PA. Nittany Lion Inn and **Pennsylvania Water Works Operators' Association.** Sec'y-Treas., I. M. Glace, 22 South 22nd St., Harrisburg, Pa. Dormitories)

Aug. 24-25—DULUTH, MINN. (Hotel Duluth)
**Minnesota Section A.W.W.A.** Sec'y-Treas., R. M. Finch, W. & T. Co., 416 Flour Exchange, Minneapolis, Minn.

Sept. 12-15—MONTREAL, QUEBEC, (Hotel Windsor.)
**New England Water Wk's. Ass'n.** (Annual Convention). Sec'y, Frank J. Gifford, 613 Statler Bldg., Boston.

Sept. 20-22—LANSING, MICH. (Olds Hotel)
**Michigan Section A.W.W.A.** Sec'y, M. N. Gerardy, Water Board Bldg., Detroit, Mich.

Meeting Jointly with

**Michigan Conference Water Purification.** Sec'y-Treas., R. J. Faust, Michigan Dept. Health, Saginaw, Mich.

Sept. 25-26—DICKINSON, N. D.
**North Dakota Water & Sewage Conference.** Sec'y-Treas., L. K. Clark, Bismarck, N. D.

Oct. 5-6—READING, PA. (Berkshire Hotel)
**Four States Section A.W.W.A.** Sec'y-Treas., Carl A. Heckmer, Washington Sub. San. District, Hyattsville, Md.

Oct. 9-11—PITTSBURGH, PA. (Hotel Wm. Penn)
**American Public Works Association.** Exec. Director, Frank W. Herring, 1313 East 60th St., Chicago, Ill.

Oct. 11-13—KANSAS CITY, MO. (Hotel President)
**Missouri Valley A.W.W.A.** Sec'y., Earl L. Waterman, University of Iowa, Iowa City, Ia.

Oct. 16-19—DALLAS, TEXAS
**Southwest Section A.W.W.A.** Sec'y-Treas., Lewis A. Quigley, 3320 West Berry St., Fort Worth, Texas.

Oct. 17-20—PITTSBURGH, PA. (Hotel William Penn)
**American Public Health Association.** (68th Annual Meeting). Exec-Sec'y., Dr. Reginald M. Atwater, 50 West 50th St., New York City.

Oct. 19-21—ATLANTIC CITY, N. J. (Hotel Haddon Hall)
**Pennsylvania Water Works Association.** (Annual Meeting). Sec'y, F. Herbert Snow, 507 Telegraph Bldg., Harrisburg, Pa.

Oct. 19-20—HAMILTON, ONT. (Royal Connaught Hotel)
**Canadian Institute on Sewage & Sanitation.** Sec'y.-Treas., A. E. Berry, Ontario Dept. of Health, Parliament Bldgs., Toronto, Ont.

Oct. 20-21—ATLANTIC CITY, N. J. (Claridge Hotel)
**New Jersey Section A.W.W.A.** Sec'y, H. N. Lendall, Rutgers University, New Brunswick, N. J.

Oct. 25-28—SAN FRANCISCO, CALIF.
**California Section A.W.W.A.** Sec'y-Treas., Burton S. Grant, Civil Engr., Bureau of Water, Los Angeles, Calif.

## CATALOGS AND LITERATURE

**"Sedimentation"**—is a new 40 page bulletin from The Dorr Co., it describes in detail types of Dorrco Sifeed Clarifiers, both circular and square. It presents the history of sedimentation practice to date, and the underlying theory of the subject. Many blue-print reproductions show mechanical details, and various types of layouts, with pictures of Dorrco Clarifiers at a number of typical plants of various types and sizes. Then follow several pages of representative operating data at 13 plants, including plain sedimentation, activated sludge and chemical precipitation. Amongst these are the novel and economical Curie Claraetor and also the 28 acres of 72 Dorr Clarifiers near Yuma, Ariz., at the Desilting Works of the All American Canal, with a capacity of 8,000,000,000 gals. and 70,000 tons of suspended solids per day. The other sizeable plant is the Southwest Activated Sludge plant of the Chicago Sanitary District with 32 Clarifiers to handle 400 m. g. d. for the World's Largest Activated Sludge Plant. For a copy of Bul. No. 6191 write The Dorr Co., 570 Lexington Ave., New York City.

*When father was a boy*

Even so short a time ago as our father's generation, there was still much localized resentment against installing "these damnfangled costly water systems". "If our water was good enough for my father to drink . . ." was heard in many a town meeting of that time.

Today, the typhoid rate of North America is the lowest in history . . . adequate confirmation that liquid chlorine is doing its job well.

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Solvay Liquid Chlorine shipments are now routed from Syracuse, New York; Hopewell, Virginia; and Baton Rouge, Louisiana. Your inquiries on Solvay Liquid Chlorine are cordially solicited. Please write to the nearest branch office listed below.

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In the Accelator, raw water is positively mixed into a body of chemically impregnated slurry containing previously precipitated solids and recirculated through the mixing, reaction and slurry pool zones. Because treating reagents are applied to the water in a new way and the reactions take place under new conditions, clarified treated water separates from the circulating slurry pool in a fraction of the time required in any other water treating process.

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Bulletins 1820 and 1821 tell you *what* the Accelator is, *how* it operates, and *why* it has so many advantages over any other method of lime or lime-soda water treatment.

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**"Telemetering"**—with a "Bailey Synchro-Meter" is the subject of a new bulletin from Bailey Meter Co., which describes and illustrates in some detail a simple electrical mechanism which transmits, indicates, records and integrates liquid flow, reservoir or tank levels, pressures or temperatures from distant points to central stations, or from one outlying station to another. The bulletin emphasizes the fact that accurcies with the "Synchro-Meter" system equal those of mechanically operated equipment; that the amplifier sends no reaction back to the transmitter; that variations in voltage (95 to 125 volts) and power factor, within reasonable limits, dos not affect the system. The principles of operation of the equipment are illustrated by wiring diagrams done in color. For a copy of "Bailey Synchro-Meters", Bul. No. 194-A, write Bailey Meter Co., Cleveland, Ohio.

**"Homelite Portables"**—are presented in a folder which pictures and briefly describes the widely known Homelite line of compact portable Centrifugal Pumps, Air-Compressors, Electric Generators, Air Blowers. The 2 in. pump weighs only 82 lbs.; pumps 8,000 g. p. hr.; is automatically self-priming on lifts up to 28 ft.; is driven by a self-contained gasoline motor. The blower, so useful for purging manholes, sewers, tanks or sumps, weighs only 70 lbs. (with engine); supplies 2,000 cu. ft. of air per minute. There are three 120 volt generator units with capacities of 650, 1000 and 1250 Watts. The 1000 Watt unit produces A. C. current of 50 to 60 cycles; weighs 100 lbs. complete. The D. C. units so popular for flood lightning in emergency or repair work weighs only 70 lbs. The A. C .unit naturally has a wider field of usefulness than for flood lighting alone. Then, there is a portable compressor which produces 150 lb. pressure; weighs but 82 pounds. For "Homelite Portables in Review" write Homelite Corporation, 84 Riverdale Ave., Port Chester, N. Y.

**"Aparatos Chloradores"**—the product of %Proportioneers, Inc. % is the subject of a special illustrated bulletin printed in Spanish for distribution in Spanish speaking countries—the outgrowth of extensive travels of Jeff Corydon through our Latin-American sister republics in Proportioneers' "Treatment Trailer". Possibly he found some difficulty in explaining in English all of the good things about "Chlor-O-Feeders," "Ammo-O- Feeders" and %Proportioneers% allied proportional feed equipment. In any event the new bulletin should prove especially informative and useful to Central and South American engineers and chemists. For a copy of this new bulletin describing "La Pequena Boruba Rojas" for chlorination and ammoniation, write %Proportioneers, Inc.%, 9 Codding St., Providence, R. I.

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**"The Hungerford Air-Water Wash"**—for filters is described in a bulletin from Hungerford and Terry Inc., long experienced filter designers. The Hungerford system makes use of strainer pipes of corrosion resistant cast chrome-nickel-iron into which the selfcleaning brass and monel-metal strainers are screwed. The air manifold, and ⅜ in. lateral pipes of red-brass, are above the fine gravel on 7½ inch centers. The air orifices are slits so cut as to preclude entry of even the finest sand particles. The bulletin points out in effect, that the

only thing that was ever wrong with the economy producing air-water filter wash system was the way it was designed and used—or rather abused. With this statement there are many who are willing to agree, as is true of the inference that an ounce of air *scrubbing* is worth a pound of high velocity water floatation of a sand bed. There are some good thoughts and suggestions in Hungerford's Bulletin 23. For a copy, write Hungerford and Terry, Inc., Clayton, N. J.

**"Soft Water for Little Rock"**—is the theme of an attractive booklet produced by Lock Joint Pipe Co. It picturizes the new water supply system of Little Rock, Ark., involving a dam and a 32 mile pipe line of 39 in. Lock Joint Pressure Pipe to a new 16 M. G. D. Filter Plant near the center of the City. The method and equipment used in local production, handling and laying of the Lock Joint Pipe, is described and attractively picturized. Posibly the most interesting chapter is that devoted to the method employed in evaluating pipe of various materials for this important gravity supply-line bringing in an aggressive (10 part hardness) water. In projecting pipe line capacities for some years in advance (and, thereby, rates of depreciation expectancy), penalty and premium factors for applying to bids on pipes of cement lined cast-iron, bituminous enameled steel and reinforced concrete, were arrived at. The respective service life was assumed at 50 years for steel, 70 years for reinforced concrete and 100 years for lined cast-iron. For a copy of "Soft Water for Little Rock" write Lock Joint Pipe Co., Ampere, N. J.

**"Yeomans Sewage and Trash Pumps"**—are presented in an illustrated bulletin just received from Yeomans Brothers. The particular pumps described are Ball Bearing Horizontal Open Impeller Pumps, (Series 6150) which features the readily adjusted impeller clearance to maintain effiencies; and, the rugged bearing housing, (cast in one unit with the pump support) to preclude heating of bearings or loss of alignment due to weight of piping attached to the pumps. Special "Yeomalite" treatment for impellers is available to protect the impeller against corrosive or gritty liquids. For a copy of Bul. 6150 write Yeomans Brothers Co., 1433 North Dayton St., Chicago, Ill.

**"Rough on Roots"**—Is *our* caption for a little leaflet from the Tennessee Corporation—manufacturers of copper sulphate and other chemicals. This little leaflet tells in simple terms how sewer choking roots can be "stopped dead" merely by putting a handful or two of copper sulphate into a man-hole above the trouble zone. The killed rooth growth soon breaks loose at the feeder stem, and is swept down sewer.

The favored way for a telephone or electric utlity line maintenance man to kill an offending tree-top or branch, without a major operation, is to drive a copper nail into the branch or limb up to its head, and let nature take its course. Fortunately (or otherwise), while coppering a sewer is "rough on roots" it does not kill the offending tree. If you have root problem (and who doesn't?) write for the how of "Sewer Coppering." Address the Tennessee Corp., Atlanta, Ga.


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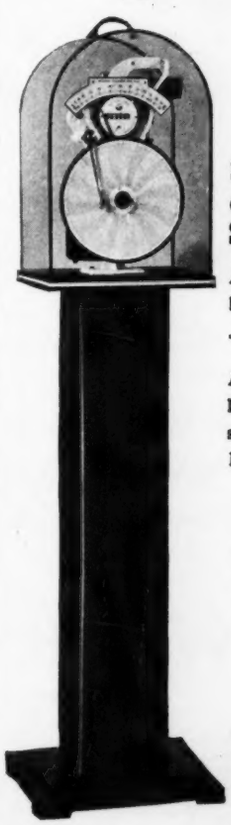

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*Close May 18, 1939*

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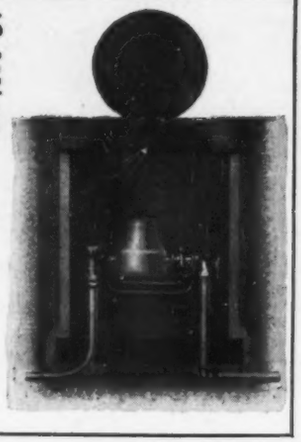

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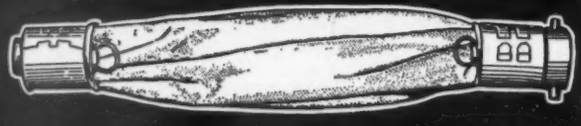

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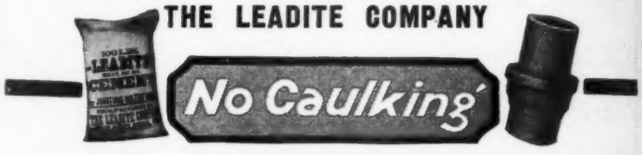


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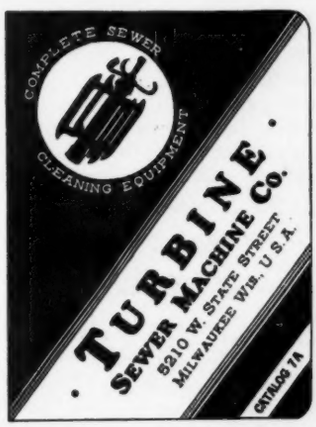


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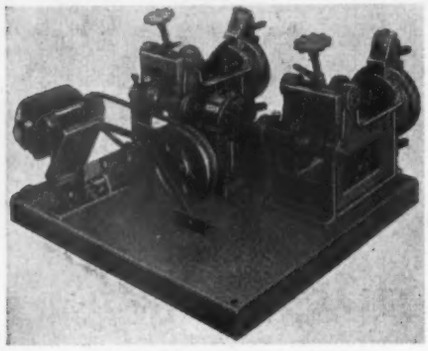

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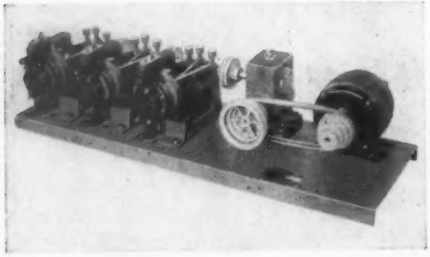

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*at*
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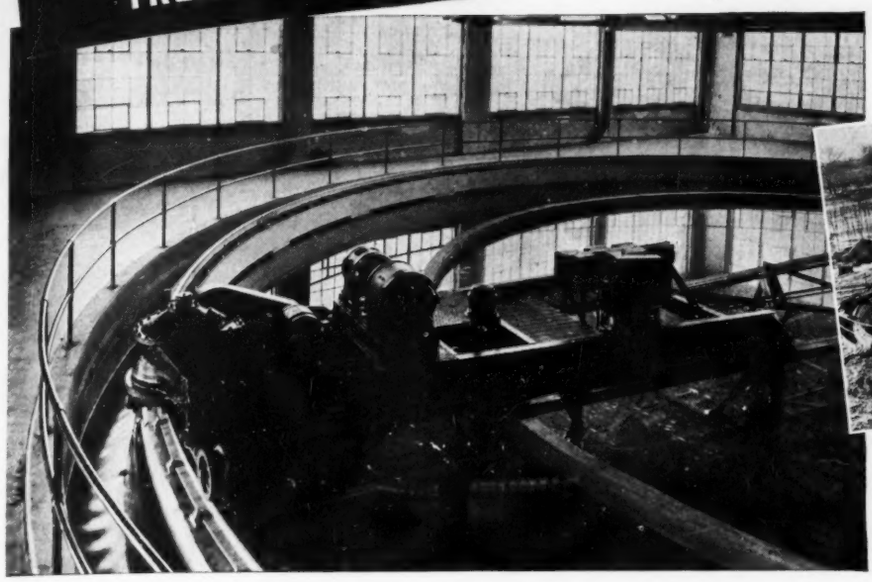

LEFT: One of two 60' Dorr Clarifiers at Dearborn, equipped with an 8' wide Magnetite Filter—Upflow Type.

ABOVE: A third Clarifier-Filter combination now being erected at Dearborn.

## *Chemical Precipitation* PLUS *Magnetite Filters*

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| Year[1] | Aver. Flow M.G.D. | Chem. Cons.-Lbs. Per M.G. CaO | $FeCl_3$ | Paper | B.O.D.'s-PPM Raw | Filtered | Rem. | Susp. Solids PPM Raw | Filtered | Rem. | Estimate[2] of Chem. Cost Per M.G. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1932-33 | 2.0 | 976 | 231 | 282 | 257 | 31 | 88% | 968 | 32 | 95% | $10.48 |
| 1933-34 | 1.6 | 303 | 224 | 76 | 236 | 29 | 88 | 1136 | 27 | 98 | 6.30 |
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| 1937 | 3.0 | 112 | 156 | — | 125 | 39 | 68 | 345 | 30 | 90 | 3.79 |
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Notes: 1. Period covered—May 1932—Dec. 1938
2. Lime assumed at $12.00 per ton; Ferric chloride at 2 cents per pound

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**76% REMOVAL B.O.D.**
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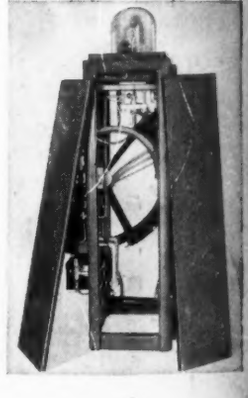

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